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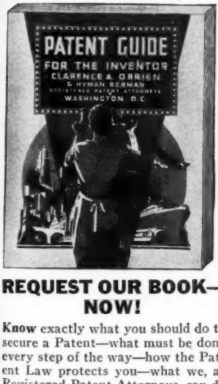

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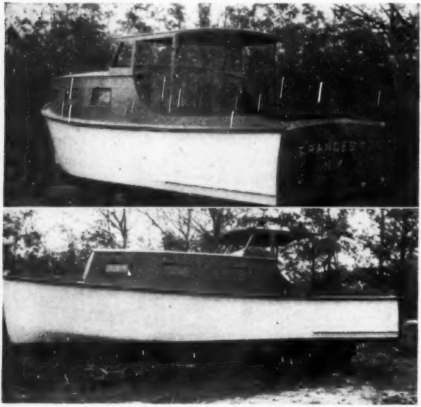

John Connelly used plenty of "elbow grease" to build this 24-foot motorboat, but now he can look forward to years of boating pleasure. MI plans were used. Upper photo provides a clear view of the cockpit. Note lathe-turned steering wheel.

THE poets say that in the spring a young man's fancy turns to love, but one look at the mailbag has convinced me that they must have meant a love that is spelled b-o-a-t, for the spring weather has resulted in a deluge of boat photographs which were sent in by MI reader-craftsmen. Big boats, little boats—sailboats, motorboats and rowboats—everyone, it seems, is building a boat.

Top of the lot and winner of this month's first prize of $5 is the project photo sent in by John Connelly, of Medford, N. Y., showing the *Gannet* motorboat he constructed from MI plans. The boat is 24 feet in length and a Gray six-cylinder marine engine provides power which, it is expected, will enable a speed of 14 m. p. h. to be attained when the craft is launched.

You've turned out a really first class job, Connelly, and I know you are going to enjoy every minute spent on the water. Good luck to you!

Spring weather is also an incentive to trailer enthusiasts and a photo of his home-built house-on-wheels won a $3 prize for Albert Crookes, of Wallingford, Conn. Weighing 1,800 pounds, the trailer is 16 feet long and 6 feet, 8 inches wide. Sleeping four persons, the traveling home has complete equipment including a sink with running water (12-gallon tank), icebox, stove and electric lights. The top and upper half of the sides are finished in silver leatherette material. Well done, Crookes. How about sending me a postcard from the furthermost point you reach on your next trailer trip?

***

A $3 prize was awarded to Ed H. Gibson, of Grove, Okla., for the photo of his enlarger which makes use of a motion picture projection lens, a small cardboard stop being inserted half-way between the two lenses in the barrel to sharpen the image and cut down the light. He reports excellent results with minicam "shots" up to 2¼ x 1⅝ in size. Two sweet potato cans and a gallon-size developer can constitute most of the enlarger. Very clever, Ed, and well worthy of a prize. It certainly pleases me to see some of the professional-looking projects turned out by MI photography "bugs."

[*Continued on page* 12]

Justine Crookes poses in front of the trailer her father, Albert, built and named for her. It is 16 feet long, 6 feet, 8 inches wide and weighs about 1,800 pounds ready to roll.

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Editor's Workbench Chips

[*Continued from page 10*]

Ed. H. Gibson constructed this enlarger, using a motion picture projector lens, two sweet potato cans and a gallon-size developer can. It handles minicam "shots" up to 2¼ x 1⅝.

Midget racer fans will be interested in the photo sent in by Charles Lucas which shows the car he built. Powered by a motorcycle engine, the car has a wheelbase of 72 inches, a front wheel tread of 44 inches and a rear tread of 45 inches. Most of the parts used to construct the racer were salvaged from old automobiles. Nice work, Charles. Watch for MI's check for $3 in the mail.

***

A photo of a gasoline-powered model airplane of his own design won a $3 prize for Stanley Hayward, of Morristown, N. J. The not-so-miniature aircraft has a wingspan of 6 feet, 7 inches, weighs 3 pounds and is powered by a gasoline motor of one-fifth horsepower. Happy landings, Stanley.

***

Another boating enthusiast who scored a $3 prize is Wallace L. Jaeger, of St. Albans, N. Y. Although only 14 years old, Wallace built the

[*Continued on opposite page*]

Parts of old automobiles picked up at local junk yards were used by Charles Lucas to build this trim looking midget racer. Wheelbase is 72 inches and a four-cylinder motorcycle engine provides power. A chain drive is featured.

Editor's Workbench Chips

[*Continued from opposite page*]

Stanley Hayward designed and built this gasoline-powered model plane. It has a wingspan of 6 feet, 7 inches.

trim kyack shown in the photograph below. Following MI plans, he found the construction job was greatly simplified and the expense was kept down to about eight dollars. The kyack is 14 feet, 7 inches in length. Congratulations on your workshop skill, Wallace.

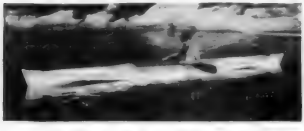
***

Scoring his second Workbench prize in six months, Charles A. Dean, of Sacramento, Calif., sent in a picture of the photo enlarger he constructed from plans that appeared in the November, 1938 issue. He says the enlarger is "tops," having enlarged 2¼ x 3¼ negatives to 8 x 10 size with excellent results. Okay, Dean, I'm sending you MI's check for $3.

***

Creating joy for his two sons, Ed and Art, E. J. Prochaska, of Chicago, Ill., constructed a sidewalk runabout, a photo of which appears

[*Continued on page* 14]



Although only 14 years old, Wallace L. Jaeger built this kyack at a cost of about $8. It is 14 feet, 7 inches in length.

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Editor's Workbench Chips

[*Continued from page 13*]

below. Powered by a two-cycle gasoline-type washing machine motor, the tiny car travels at a speed of 15-20 m.p.h., providing ample thrill for the youthful drivers who take turns at the wheel. Its a nice looking job, E. J., so I'm sending you a $3 prize check.

***

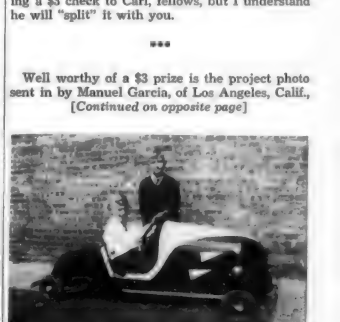
Strolling along a river or lake bottom is a thrill you can enjoy by building an underwater diving helmet like the one on page 15, which was constructed from an old hot water boiler by Carl Peterson, William Winter and Louis Stiglich, of Chicago, Ill. Following MI plans, the boys are now constructing six more helmets for the use of members of an amateur diving club they have organized. I'm sending a $3 check to Carl, fellows, but I understand he will "split" it with you.

This picture of his home-built enlarger enabled Charles A. Dean to score his second Workbench prize in less than six months.

***

Well worthy of a $3 prize is the project photo sent in by Manuel Garcia, of Los Angeles, Calif.,

[*Continued on opposite page*]



Ed and Art Prochaska take turns at driving this sidewalk runabout which was built for them by their dad. A washing machine motor provides power and top speed is 20 m.p.h.

Editor's Workbench Chips

[*Continued from opposite page*]

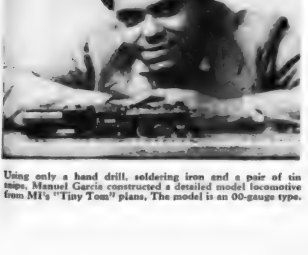
Carl Peterson, William Winter, and Louis Stiglich built this underwater diving helmet from MI plans. They are now building six more for members of their new amateur divers club.

showing the Tiny Tom 00-gauge model locomotive he constructed from MI plans. Using only a hand drill, soldering iron and a pair of snips, Manuel built the model in about two weeks' time which certainly is an indication of his skill. Great work, Manuel.

***

From far away Australia, I received a letter from Mervyn Cooper, who says he would like to correspond with MI readers interested in midget racing and stamp collecting. If you

[*Continued on page* 16]



Using only a hand drill, soldering iron and a pair of tin snips, Manuel Garcia constructed a detailed model locomotive from MI's "Tiny Tom" plans. The model is an 00-gauge type.

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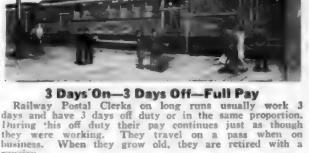

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Editor's Workbench Chips

[Continued from page 15]

would like to make a Pen Pal, write to him at Curran Street, East Oakleigh, Melbourne, Victoria, Australia.

***

One of the best model boat projects I have seen for quite some time is shown in the photo sent in by Kenneth Brearley, of Letdbridge, Alberta, Canada, who was awarded a $3 prize. A glance at the photo clearly proves that Ken's craftsmanship rates high and I can readily believe him when he claims it required one full year to complete the stately Spanish Galleon model. It was worth it, Ken, for you certainly turned out a first class decorative job.

***

Another model boat builder whose project photo scored a $3 prize is Edward Bogda, of Vaux Hall, N. J. Ed built a sailboat model which stands 9 feet high (keel to mast tip) and has an overall length of 6 feet. The sails are made of oil silk and the deck is comprised of mahogany and sugar pine. All hardware and brass work were made by hand, keeping cost of construction below three dollars. Well, with the MI prize in your pocket you can now say the boat cost you nothing but labor, Ed. It sure is a swell job.

Stately in appearance is the Spanish Galleon model which was built by Kenneth Brearley.

***

A $3 prize was awarded to Tom Hunt for a photo of the sidewalk runabout he built. Power is provided by a rebuilt generator motor of ¾ horsepower and a speed of about 10 m.p.h. is claimed. He used MI plans plus a few ideas of his own in constructing the car, spending about $35 on the job. Looks like a pretty sturdy job, Tom.

***

An increasing number of gas model airplane photos are popping up in the Workbench mail, one of the latest being sent in by Clayton Thoms, of Philadelphia, Pa. His model has a wingspan

[Continued on opposite page]

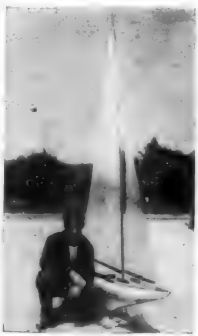
Editor's Workbench Chips

[*Continued from opposite page*]

of 7 feet, 6 inches and is powered with a miniature gasoline engine of ⅓ horsepower which is fitted with a timing device to regulate the motor run. Al's check for $3 is on the way to you, Clayton.

***

Raymond L. Taylor, of Trenton, Tenn., was awarded a $3 prize for sending a photo of his home-built garden tractor. Powered by an old washing machine motor, the two-wheeled tractor has many special features developed by Ray. The motor is on a sliding base so that is position can be changed, thereby tightening or loosening the belt to provide a smooth clutch action. The left handle is geared so that when it is pulled to right or left it causes the plow gang to shift in the desired direction. When the plows are steered the tractor is automatically turned in the proper direction. You certainly earned the Workbench award, Ray. I'm willing to bet you'll receive a lot of mail from MI readers who will want to build a similar tractor.



Standing 9 feet high, this model yacht was built by Edward Bogda. The sails are made of oiled silk.

***

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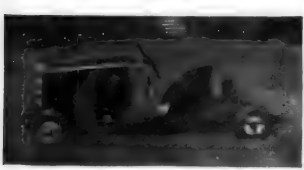
[*Continued on page* 18]



This sidewalk runabout was constructed by Tom Hunt in about two months. A rebuilt generator motor of ¾ horsepower enables the tiny car to travel at a speed of 10 miles per hour.

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Editor's Workbench Chips

[*Continued from page* 17]

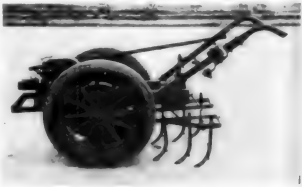
A scalloped wing covering design adds beauty to the gasoline-powered model airplane built by Clayton Thoms. It has a wing-span of 7½ feet and is powered by a motor of ⅕ horsepower.

Walter H. Hayden, of Worcester, Mass., whose home-built sailboat photo won a $3 award. He built the boat from his own plans at a cost of $90. The craft is 15 feet, 2 inches long with a beam of 6 feet, 4 inches. The sail was cut from airplane cloth and has an area of 160 square feet. Appears to be a good design, Walter.

***

Add to the list of fathers who have built midget racers for their sons the name of Denny Krick, of Robinson, Ill. Powered by a gasoline engine of ⅝ horsepower, the tiny car attains a speed of 25 m.p.h. The frame is made of oak and the body from auto metal with a radiator of cast aluminum. Only one wheel is keyed to the axle, thereby creating the differential action. Watch for MI's check for $3 in the mail, Krick, and

[*Continued on page* 20]



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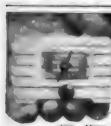

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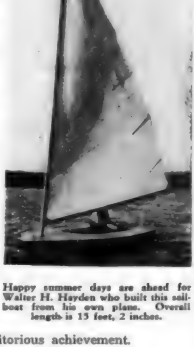
Editor's Workbench Chips

[*Continued from page 18*]

accept my congratulations for turning out such a well built car.

***

Following plans that appeared in the March, 1939 issue, Charles W. Stetter, of West New York, N. J., constructed the photo enlarger shown on page 22. Friends discovered how well the enlarger worked and turned over their enlarging jobs to him, enabling him to earn enough money in six months to purchase a $45 camera, darkroom equipment and other photographic supplies. That's what I call making a hobby pay dividends, Charles, and I am pleased to award you an MI Workbench prize of $3 to top off your meritorious achievement.

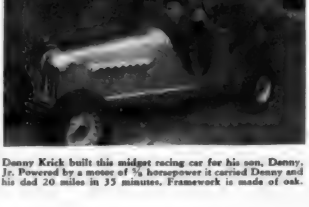


Happy summer days are ahead for Walter H. Hayden who built this sailboat from his own plans. Overall length is 13 feet, 2 inches.

***

A real prolific model airplane builder is Forrest James, of Muncie, Ind., whose prize winning

[*Continued on page 22*]



Danny Krick built this midget racing car for his son, Danny, Jr. Powered by a motor of ⅓ horsepower it carried Danny and his dad 20 miles in 35 minutes. Framework is made of oak.

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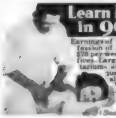

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Editor's Workbench Chips

[*Continued from page 20*]

Proudly posing with the four gasoline-powered model airplanes he constructed is Forrest James, of Muncie, Ind. All the models are powered by motors of ⅕ horsepower and have made many successful flights.

photo shows the four gasoline-powered models he constructed, two of which are his own design. All are powered by miniature engines of one-fifth horsepower and have made many flights without a serious crack-up. Forrest says he has been building model airplanes for 14 years, which proves the fascination of the hobby. I'm sending you a $3 check, so you'll be able to say your models made a three-point landing on the Workbench table, Forrest.

***

Maybe MI should start a "Father and Son Midget Racer Club" for page 23 shows another tiny car built by a father for his son. Awarded a $3 prize, the photo was sent in by Nicholas E. Dikon, of Reinerton, Pa., and shows the car he built for his son, Robert. He used parts from 10 different makes of junked autos as as well as a two-cylinder motor from an old motorcycle to build the car and claims it will travel at a speed of 50 m.p.h., although he has cautioned Robert not to go faster than about 15 m.p.h. (Better put a governor on the motor, Dikon, for safety's sake). The car is equipped with a foot brake and an emergency brake and the transmission provides three forward and one reverse speed. An electric starting motor, generator, head lights, tail light, horn and speedometer are featured equipment. Your craftsmanship rates A-1, Dikon.

With this enlarger, which he built from MI plans, Charles W. Stetter has earned enough money to purchase a $45 camera and complete darkroom equipment.

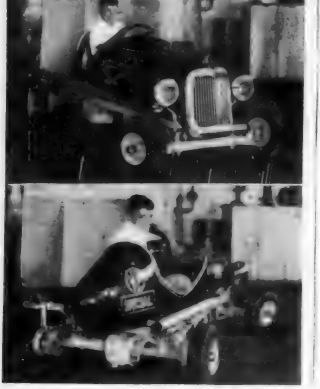
***

Once more I want to warn contributors to the

[*Continued on opposite page*]

Editor's Workbench Chips

[*Continued from opposite page*]



The front and rear views of this midget racer clearly show its sturdy construction. Built by Nicholas E. Dikon, the car is powered by a motorcycle engine and speeds along at 50 m.p.h.

Workbench to be sure and include their complete address when sending in letters and photographs. Many writers fail to do this and I am therefore unable to correspond with them in the event the photos are judged to be worthy of a Workbench prize. Do not clip your photos to your letters as the clip sometimes presses so tightly that it mars the photograph for reproduction purposes. Also—send CLEAR photographs of your projects if you would win an MI check.

***

Winning a $3 prize, a photo sent in by Robert Peel, of Mt. Pleasant, Utah, shows the model sailplane he constructed. The model has a wingspan of 48 inches and is 29 inches long. The wing is elliptical in shape and is built around a 3/16-inch spar. Balsa wood was used throughout the construction.

In launching the model sailplane, Peel uses a novel method which, he claims, works out very well. A thread is attached to a hook on the nose of the glider and the other end of the thread is held by a friend riding on a bicycle. As the bike rider moves forward, Peel runs behind with the glider in his hand. In a few seconds the glider is released and climbs upward until it assumes a

[*Continued on page 24*]

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Editor's Workbench Chips

[*Continued from page 23*]

Built by Robert Peel, this miniature sailplane has a wingspan of 48 inches. Launched by being towed at the end of a string held by a man riding a bike the sailplane quickly gains altitude and makes some excellent soaring flights.

position directly over the man on the bike, upon which the thread slides from the hook and the glider soars away on the air currents. Try Peel's method of launching a model glider if you want a real thrill, fellows.

***

What hobby is most popular with MI readers? This is a question I would like to know the answer to and only you, the readers of this magazine, can provide it. Why not take a few minutes to send me a postcard or letter listing your favorite hobbies in the order of their appeal to you? It certainly would help me to select articles for future presentation in these pages, thus making certain that you will find your hobby among those given space throughout the year. How about it, fellows?

***

See you here next month—THE EDITOR.

Correction

The "Human Fish" story describing how movies are made under water, originally scheduled for this issue, had to be held out for reasons beyond the publishers' control. This story will definitely appear in the July issue.

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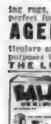

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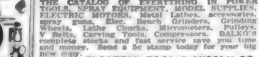

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New Lightplane Developed

Designed by Harold E. Emigh, of Denver, Colorado, a new lightplane is powered by a 50 horsepower engine and features a tricycle landing gear with a steerable nosewheel. Carrying two persons, side by side, the new airplane is of all-metal construction except the tail surfaces which are fabric-covered. The tapered wing has a span of 35 feet, 9¾ inches and an area of 140 square feet. Overall length is 22 feet, 3 inches. Cruising speed is said to be about 105 m.p.h. and cruising range is 450 miles, which is considerably more than that featured by the average plane of equal power and size.

Air Corps Receives Bid For Experimental Plastic Plane

The Aircraft Research Corporation of Bendix, N. J., has submitted to the Army Air Corps material division at Wright Field in Dayton, Ohio, a bid for an experimental "plastic" airplane manufactured by a secret process praised by engineers as "one of the cheapest and simplest ever devised," it has been learned.

The plane will be made by wrapping a flexible plastic-bonded plywood around collapsible formers. Then plywood and formers are inserted into a sealed rubber bag, from which the air is exhausted. Atmospheric pressure collapses the bag tightly around the wing or fuselage section, pressing plywood tightly against formers. The bag and formers, after removal of the part, may be used over again. The process dispenses with costly molds or dies required by other methods of forming plywood planes.

Details of the bid, submitted by Eugene L. Vidal, president of the company and former Bureau of Air Commerce chief, are being withheld. The bid was submitted immediately after public opening of quotations for an Army attack ship design, everyone then present in the room but Mr. Vidal and the Army officer in charge leaving. The Air Corps' decision on acceptance of the bid will not be known for some time.

A scientist has recorded visibly the trills and chirps of crickets, in order to study their music.

New Vacuum Pumps Create Lowest Man-Made Pressure

The emptiest man-made space ever attained is now being created by the newest vacuum pumps which use oil molecules to sweep out the air from scientific apparatus.

While it is impossible to produce a perfect vacuum a vacuum can be created in which it is possible for a molecule to travel nearly 500 feet (15,000 centimeters) before it would encounter another molecule.

Since a molecule is only about .0000001 centimeter in diameter, it means that in traveling 15,000 centimeters the molecule goes over 100,000,000 times its own length before encountering a companion. Here, truly, is loneliness.

If the same emptiness were applied to people it would mean that a man 5.2 feet tall would have to travel over 100,000,000 miles before meeting anyone. The loneliness would be much greater than if there was only one man on the earth and another on the sun.

In terms of atmospheric pressures the new oil diffusion pumps, as they are known, can produce pressures of .00000005 millimeter of mercury without the use of cooling traps of liquid air.

Normal atmospheric pressure is 760 millimeters of mercury which is more than a billion times that attained in the newest oil diffusion pumps.

In operation the new pumps consist of elaborate and beautiful glassware arranged in tubes and columns to make a complete circuit for the vapor of the oil.

The oil is heated at one point in the circuit and the vapor flows around the loop. As the flow passes a specific point it comes by an opening leading to the chamber to be evacuated. Molecules of air coming out this opening are bumped by the oil molecules and the latter knock the air molecules away from the container being evacuated.

Dr. K. Hickman and his associates at Eastman Kodak Company developed the new pumps which are now in commercial production.

Helium II Provides Thinnest Liquid Film Known To Man

Helium II, one form of liquid helium that is so fluid it behaves almost like a gas, forms about the thinnest liquid films that scientists have yet been able to produce. A. K. Kikoin and B. G. Lasarow, of the Ukrainian Physical-Technical Institute in Kharkov, report to the British journal, *Nature*, that they have produced films of the cold substance so thin that it would take a quarter of a million of them piled up to measure an inch in thickness.

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New Optical Glass Has High Light-Bending Power

A discovery which may be a major stride in the advance of photography and which permits lens makers to produce "faster" and better lenses has been made by Dr. George W. Morey of the Geophysical Laboratory of the Carnegie Institution in Washington, D. C.

The discovery of a way to make optical glass out of rare chemical elements instead of common silica permits the production of a glass which has a very high index of refraction and a low dispersion. This means a lens which serves the photographer more efficiently.

Some of the optical glasses of Dr. Morey have the highest index of refraction (light-bending power) ever reported; more than 2.00. Only comparable refraction is that of the diamond, which is about 2.41.

The optical properties of glass used in lenses have long limited optical lens-makers in the exactness of the work they could produce. Dr. Morey's discovery of a new kind of glass should remove this present limitation.

Out of the work should come lenses of greater light-gathering power which would be a boon to all miniature camera fans who ever seek greater apertures.

Moreover, high index of refraction and low dispersion permit better corrections for chromatic aberration, the annoying property of some lenses of bringing different colors to different focuses.

Chemical elements most people have never heard of are used in producing the glass. Yttrium, lanthanum, columbium, hafnium, tantalum, zirconium, strontium, boron, and barium are typical.

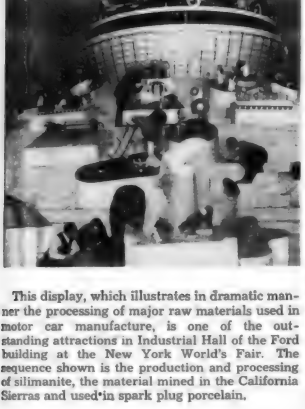
Aim of Dr. Morey is to produce a glass with an index of refraction (ability to bend light rays) of over 1.65. One glass, made of 60 per cent lanthanum and 40 per cent boron, has a refractive index of 1.72 and a dispersive index of 54.

Another composed of 33 per cent lanthanum, 41 per cent thorium and 26 per cent boron has a refractive index of 1.76 and a dispersive index of 52. As a comparison, ordinary flint glass of a lower refractive index (1.65) would have a dispersion of about 33. Small dispersion numbers mean high dispersion and vice versa.

The new work is a continuation of efforts made in America since the World War to produce better optical glass. At the time of the conflict, the United States found it had been buying most of its superior optical glass from Germany. Furious wartime research partially overcame the difficulty, but research has been going on ever since to make American optical glass equal or superior to any glass in the world. Dr. Morey's work is a contribution to this end.

An automobile costs about 20 cents a pound.

"Cycle Of Production" Shown In World's Fair Exhibit



This display, which illustrates in dramatic manner the processing of major raw materials used in motor car manufacture, is one of the outstanding attractions in Industrial Hall of the Ford building at the New York World's Fair. The sequence shown is the production and processing of silimanite, the material mined in the California Sierras and used in spark plug porcelain.

No Arc Or Sparks Visible In New Welding Process

A new welding process which makes possible automatic high speed welding of any commercially used thickness of metal has been developed by a firm in New York, N. Y.

Creating neither the sparks or flame or visible arc that characterize other welding methods, the new process uses an electric current passing directly from electrode into metal being welded to generate the heat necessary to melt the weld.

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Welds can be made 20 times faster in many applications than by other practical methods, it is stated. Low-carbon and medium-carbon as well as stainless steels and alloy metals have been successfully welded in this way.

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Model Auto Made Of Silver

Small enough to be held in the palm of the hand and weighing only a few ounces, the old-fashioned automobile model shown in this young lady's hand is comprised of more than 5,000 separate pieces of sterling silver wire. The unusual model was made about forty years ago by a silversmith in Florence, Italy, and is now owned by Philip Paval, of Los Angeles, Calif.

Future Roads Will Reflect Light Better, Says Engineer

Sponge-like pavement surfaces which absorb and waste large amounts of night illumination may be taboo on the highways of tomorrow.

In their stead may be pavements such as a new experimental surface—granite chips atop an ordinary macadam road. This was indicated by C. A. B. Halvorson, General Electric engineer before the Association of Asphalt Paving Technologists.

Experiments at Lynn, Mass., showed that black objects, visible all the time against the treated pavement, could be seen only half the time against the macadam, and that only when they were silhouetted against a light spot. Under night illumination the macadam surface is extremely irregular, portions of it appearing to be light, while the others are dark. The new pavement also increased visibility during rain.

C.A.A. Seeks Safer Airplanes

Suggested changes in the Civil Air Regulations to provide the aviation industry with an incentive for the development and use of aircraft inherently safer and easier to operate than conventional type airplanes now in general service, were made public recently by the Civil Aeronautics Authority and will be sent to aircraft manufacturers for constructive criticism. This move marked the first step ever taken by a governmental agency supervising flying activities to put a tangible premium on built-in safety in aircraft.

The Authority's action followed an informal conference with several of the country's leading light-airplane manufacturers after this subject was outlined by Edward J. Noble, Chairman of the Civil Aeronautics Authority, before the National Aviation Forum, in Washington. These men agreed that increased safety in private flying is something in which they have an even more vital stake than the Authority and said they were eager to make whatever contribution they can to get more people into the air and at the same time reduce the present accident ratio in private flying.

In making its announcement, the Authority stressed the fact that performance characteristics which it is sending out to aircraft manufacturers have not been adopted by the Authority, are purely tentative at the present time and are subject both to discussion and revision before any attempt will be made to embody them in the regulations. It is intended, however, to reduce substantially the present dual instruction and solo flying time requirements for a private pilot's certificate when and if the industry produces aircraft with safety characteristics sufficiently exceeding those of the average present-day airplane to warrant such action.

"Sled" Measures Depth Of Buried Submarine Cable

The transatlantic submarine cable the Western Union Telegraph Company plowed into the ocean bottom last year to avoid accidents caused by seine hooks turned up a minor problem in its own wake—how deeply buried is the cable?

Western Union engineers have developed a cable depthometer to tell them that, D. H. Nelson told the American Institute of Electrical Engineers recently.

Two sets of coils are mounted, one set at each end, on a "sled" the cable ship drags over the buried cable. Magnetization changes caused by the presence of the steel cable sheath set up a current in the two sets of coils, whose signals are transmitted to the cable ship and are read directly in inches, he said.

The cable ship tows the sled back and forth across the cable at several intervals. While a continuous reading is not obtained, an average of the measurements tells the cablemen how well the plow is doing.

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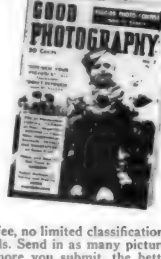

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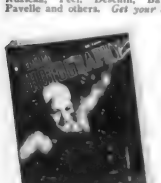

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Large Flying Boats May Use Propellers As "Brakes"

Airplane propellers as brakes?

Sounds odd, when you're used to thinking of whirling blades speeding a plane instead of stopping it. But it may soon be tried to aid in maneuvering the still bigger flying boats for transoceanic air services of future years.

Flying boat designers at a plant near Washington have asked a nearby experimental firm to test this paradoxical idea, it was learned, and thereby show once more that the unusual can and often does happen in aviation. Basis of the experiments is the fact that reversing the pitch or twist of the propeller blades reverses the direction of the airstream and slows the plane.

The designers, taking a look at available waterways where transoceanic airliners of the future will have to land and take off, base their request for action on the belief that future planes will give many a pilot a maneuvering headache. This does not, however, apply to the biggest today; the engineers are thinking of the ships still on their drawing boards.

Propellers with reversible pitch blades can do the trick and will be manufactured for the test, it was stated. Such propellers, with the blades twisted oppositely to their usual position, would reverse the direction of the airstream they create. Instead of slipping it back past the wing, they would blow it forward, slowing the plane.

This scheme—which isn't so new, since, like many other things aeronautical, it has been thought up and even tried several times before—is intended only for planes on the water or on the ground. If you lose speed in the air, you don't stay up very long.

The whirling brakes would help in maneuvering big flying boats with four or more engines by enabling a pilot to use one or two of his motors producing their reverse effect, while running the others as usual. He would be able to turn quickly—like an oarsman pulling his oars in opposite directions. In addition, all four motors could be used as brakes to come to a quick stop—something which is now rather difficult.

Two other possible uses are foreseen. Landplanes, which now have wheel brakes, might use propeller brakes. Dive bombers developing enormous velocities—which, by the way, are not desirable despite the general impression to the contrary—could use the reversible pitch propellers to slow their descent to a paltry 200 or 300 miles an hour. But there is not much call for these last two as yet.

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Samples Of Sea Bottom May Give Clue To Ice Age Level

Deep samples of the Mediterranean sea bottom, taken with a tube shot into it from a gun, would yield valuable data on the lowering of sea level a million years ago during the pleistocene Ice Age, suggests Dr. W. H. Bradley of the U. S. Geological Survey.

There is no question but that the general sea level sank during the Ice Age. It is commonly thought that the water was locked up in the great blanket of glaciers that lay mile-thick over most of Europe and North America. The only disputed point has been, how much? One group of geologists maintains that the sea level was depressed about 250 or 300 feet. Opposed to this is the thesis that it dropped nearly 3,000 feet.

The Mediterranean, which is divided into two great basins by a submerged ridge running across it from Sicily to Africa, is proposed by Dr. Bradley as a test basin in which these opposing theories may possibly find their decision.

During the Ice Age, he points out, larger amounts of fresh water undoubtedly flowed into the Mediterranean from its eastern end, because the colder, wetter climate of eastern Europe was putting more water into the Danube, Don, Volga, and other rivers, and because the Caspian and even the Baltic were connected with the Black Sea.

This increased flow of fresh water blanketed the surface of the Mediterranean, sealing over the salt water beneath and profoundly affecting its life and the character of the bottom sediments. If the sea level dropped only 250 or 300 feet, there would be some difference between the bottom character of the eastern and western basins of the sea; but it would not be nearly so great as the difference that would be found if the ancient level had once been more than 1,000 feet lower than it is at present.

It remains now for a cruise to be made with a scientific ship equipped to take the long cores of mud and silt out of the bottom that will put the two theories to actual test.

Gun Shoots Gas "Bullets"

A new type of automatic—firing gas instead of bullets—has been invented by J. W. Van Karner, New York chemical engineer and firearms specialist.

Firing a clip of three gas cartridges, the gun resembles in appearance a regular automatic. It is quickly loaded. Its cartridges disable the person at whom they are fired for about 30 minutes.

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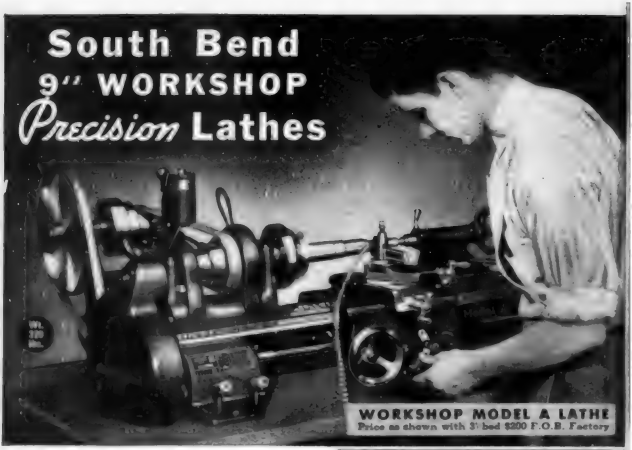

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MECHANIX ILLUSTRATED

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1939

The X-ray serves mankind in industry as well as in science. Above: Application of X-ray in the factory to examine packaged goods before shipping. Below: The largest individual X-ray ever taken. It is life-size of a fully clothed woman.

X-RAY Solves Secret of Life

Thanks to the discovery of X-ray, secrets of man and metal lay revealed to the world today. Continued study with this tool of science is destined to uncover further mysteries of life and plunge man into fabulous adventures that may change civilization.

IF YOU break an arm today, chances are the broken member will be thoroughly X-rayed before and after the fracture is set. But don't walk out of the hospital X-ray room believing the only use of the X-ray is for examination of broken bones.

The X-ray is more than the tool of the surgeon. It is a force in the change of civilization. So great a force is it in changing of sex, the reduction of infection, radio and telephone, and a score of other fields that scientists are beginning to wonder if it is not the single greatest force shaping our development toward the Utopia towards which all scientific achievement points.

The story of the X-ray of today and tomorrow is a fabulous story of amazing accomplishment, more thrilling than the wildest tale of incredible adventures ever lived by a human being.

The origin of this tool of science dates back to 1895, when the X-ray was accidentally discovered by Roentgen. That distinguished scientist was working in a darkroom with a Crookes tube covered with black paper. While an electrical discharge was passing through the Crookes tube, a cardboard screen coated with a barium chemical,

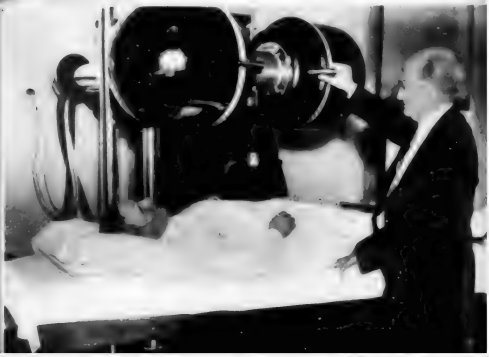
lying a few feet away, gave out a strange glow. The startled scientist studied the strange phenomenon and discovered that rays from the tube penetrated solid objects. He also discovered that a hand held before a sensitized photographic plate was actually photographed through and through! He had taken pictures through a solid!

This was amazing! The Berlin Physics Society, to which the discovery was announced, declared it one of the major discoveries of the era. However, the news of the discovery of X-ray had barely been announced when Roentgen regretted the fact. The whole world became obsessed by these new rays. Some feared them and spoke of similar rays that might bring death and destruction to whole cities and armies by remote control. Others complained of the banishment of all privacy, for here was an agency that could see right through your clothes! A bill was actually introduced into the New Jersey State Legislature forbidding the use of X-rays in opera glasses on the grounds that public modesty would be outraged—as if X-rays could be incorporated in opera glasses! A London firm actually advertised X-ray-proof underwear!

In the airplane factory as well as in the steel mill and hospital the X-ray serves to reveal to man hidden mysteries not otherwise visible. Above are shown T. A. Tripplett and V. P. Barton who invented a small, high-powered X-ray that penetrates 18 in. of solid aluminum. This device blasts a charge of 280,000 volts of electricity through the wing of a plane revealing flaws as small as one-millionth of an inch!

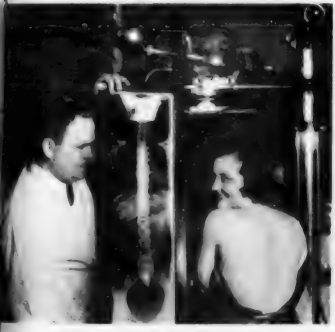
In the meantime the discovery of this new life-giving force revolutionized the scientific study of man and elements. For one thing its discovery made possible new ventures in the study of the cosmic ray. It fired the imagination of science and acted like a shot-in-the-arm in the scientific study of the atom and its hidden secrets. The discovery of X-rays enabled Madame Curie to discover radium while working in her backyard laboratory. From that day to this the lives of some 3,000,000 human beings have been saved from cancer by the use of X-rays and the radium which was discovered as a result of X-rays.

When you think of the number of human beings whose lives have been saved by the X-ray's diagnosis of tuberculosis, cancer, broken bones, infected teeth, it becomes evident how vital X-rays have been to human life. Without X-rays there would be no



Right: The X-ray is a new weapon in science's ceaseless war upon cancer. This apparatus is among the most modern and powerful X-ray machines devised for the treatment of dreaded diseases afflicting man.

The X-ray machine in the factory is used to locate defects in metal objects. (Right.) It will show up blow holes, poor welds, defective castings, etc. Arrows in above photo point to defects in a casting. Below: The most popular use of the X-ray is for the location of bone fractures, study of the vertebrae, chest, etc. It is one of medical science's greatest aids.



radio as we know it today. For the radio is the child of the electron and the electron owes its recognition to the ionization of air by X-rays. And were it not for X-rays we would not have sound movies, or long distance telephones, or radio beacons to guide airplanes, or a multitude of other devices that rely upon electrons for their operation.

The real significance of the discovery of X-rays goes even deeper in our industrial life. X-rays made possible the study of the characteristics of metal and resulted in the fabrication of new light, strong alloys. They are used in searching for hidden flaws inside steel forgings; even stimulate plant growth in mild doses. We may expect a ten-fold increase in the efficiency of electric lighting and power by using the X-ray to enlarge our knowledge of electricity. The X-ray may eventually enable us to see what really happens inside a wire, a dynamo, a vacuum tube. The efficiency of these units, now impaired through the leakage of power, may be increased by plugging this power loss.

X-rays were followed by the discovery of radium, which in turn was found to be throwing off atoms of helium and turning into lead —and man began to speculate about creating new elements at will! The discovery of new metals has opened up exciting possibilities in chemistry and biology as well as in physics. As an example of the way these discoveries may help to remake the body of man of the future, it may some day be possible to X-ray vital organs and learn what particular foods promote their cell growth—simply by mixing radioactive substances (sensitive to X-ray) with the foods. Diseased organs may be rebuilt and bacteria killed by the radiations.

Delving still further in the field of health, science has already begun using the X-ray in "painless operations" to cure bad tonsils, goiter, sinus, even the common cold which is

[*Continued on page 85*]

Novel Device Illustrates Motion Of Electric Waves

INVENTED by C. F. Wagner (right), an electrical engineer, the queer looking apparatus shown at left is used to illustrate the movement of electrical waves in slow motion. A flat spring is mounted rigidly to each of the machine's 56 aluminum arms, which are mounted at their center of gravity on hardened steel bearings. When the first arm is moved up or down by an electric impulse it transmits the movement successively to all the other arms in the form of a wave, just as a long rope can be made to move in waves when it is snapped at one end. This performance is analogous to wave transmission on an electrical line and the surge of current can be dramatized by the machine for a period lasting as long as 10 seconds, enabling engineers to make a visual study of different wave shapes created by electricity.

"Whirlpool" Soothes Feet

CLAIMED to be beneficial in the treatment of various foot ailments by stimulating circulation of the blood, a new "whirlpool" bath machine (below) is fitted with a powerful motor which violently agitates the water. Ten minutes of the bath treatment is said to equal one-half hour of vigorous massage with the bare hands.

Tower Helps Walnut Pickers

TO SPEED up the harvesting of walnuts in groves, Travis M. Boone, of San Ramon, Calif., bolted a 36-foot steel tower atop a tractor, as shown above. Three men ride in cans attached to the tower at different heights, knocking walnuts from the trees as the tractor passes slowly through the grove.

Mail Box Folds Back To Hold Packages

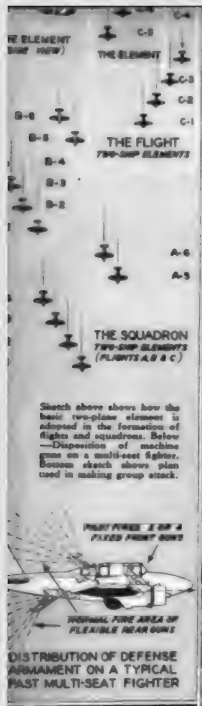
MADE of rust-resisting sheet steel, a newly developed mail receptacle features an interior wall that folds back, permitting easy access to the contents and enabling several letters to be removed simultaneously with one hand. The entire receptacle can be tilted to accommodate and provide support for small packages, as demonstrated in photo at left. A movable cover protects mail from rain and snow.

World's Fair Visitors X-Ray Ancient Mummy

HARWA, an Egyptian who lived 2,800 years ago, may be X-rayed by visitors at the New York World's Fair. By the pressing of a single button, this exhibit, one of the features in the General Electric building, is changed from a specially lighted display of a genuine mummy with its ornate coffin-lid standing nearby (left), to a fluoroscopic image of a skeleton (right) which has been hidden behind ingenious mummy wrappings applied by ancient Egyptians long before the Christian era began.

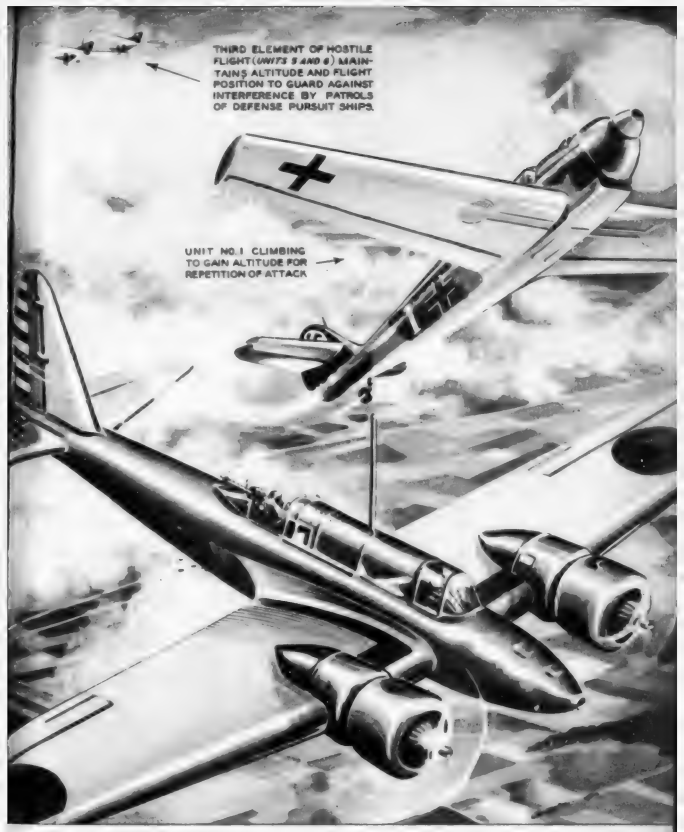
Police Dog Responds To Radio Commands

ZOE, an Alsatian police dog attached to the Sydney (Australia) Police Force, is shown performing tricks in response to commands issued to her via short-wave radio. A miniature radio receiver was strapped to the animal's back and a police officer whispered instructions into the microphone of a transmitter located some distance away. Hearing her master's voice, Zoe dutifully carried out the commands.



MODERN

INDIVIDUAL combat in the air was replaced by formation attack before the close of the World War and since that

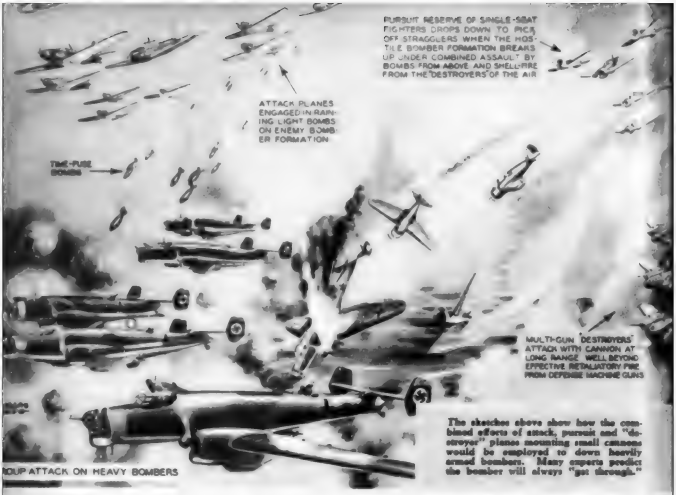


AERIAL WARFARE

by Douglas Rolfe

date formations and aerial tactics have developed until today they are all-important in modern warfare. From the smallest component, the element, to the group comprised of several squadrons, formations are now strictly adhered to by leading air forces throughout the world.

There are a bewildering number of different



The sketches above show how the combined efforts of attack, pursuit and "destroyer" planes mounting small cannons would be employed to down heavily armed bombers. Many experts predict the bomber will always "get through."

attack methods, each designed to meet the situation involved and taking into consideration the vulnerability of the craft to be attacked. On these pages the artist has illustrated typical attack tactics in which a flight, or "Kette," of German Messerschmitt Jaegers (German terminology for pursuits) are engaging a modern multi-gun fighter—each the highest performance military plane of its class in the world.

For purposes of illustration the attack is shown directed on an isolated plane, but were the attack directed against a flight or an even larger formation the tactics would be similar. In the case of a squadron attack upon another squadron the first flight attacking would seek to pick off the enemy leaders and the second assault flight would come down to disperse the squadron while the third flight would keep station to act as reserve and protective flight.

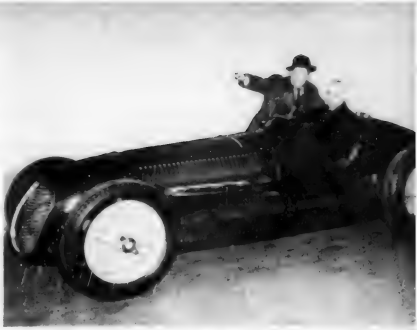
In the sketch on page 41 the situation looks desperate, indeed, for the attacked plane, but in actual practise a well-manned fighter of this type is often as not more than a match for quite a number of pursuit planes. With stout-hearted, well-trained gunners handling the flexibly-mounted rear guns and a skillful pilot maneuvering the plane while firing the front fixed guns the odds are nearly even, the superior speed of the pursuits being offset by the greater degree of skill required to direct successfully the fire of their fixed guns on the highly maneuverable and well-armed target.

The latest tactics in attacking large formations of heavily armed bombers is based on the use of the newly developed twin-engined fighter planes and is distinctly novel in other ways. The plan of attack is to have fast single-engined attack planes fly over the hostile aircraft and shower them with light time-fused bombs while the twin-engined fighters, with their small cannons, remain out of machine-gun range and pour high explosive shells into the enemy formation, as sketched above. This combination of bomb and shell attack is calculated to break up the formation whereupon the reserve pursuit planes come diving down from aloft to engage the scattered bombers, downing them by concerted attack.

Although the effectiveness of aerial warfare has been scoffed at by some military authorities, it is noteworthy that the nations of the world are engaged in a race to build the largest air force within the shortest time and are teaching thousands of civilians to fly in an effort to create a reserve of military pilots for use in an emergency.

Will This Racing Car Win 1939 Classic?

RALPH De PALMA, famed racing car driver, is shown seated in the new Maserati speedster which Cotton Henning (standing), Indianapolis racing expert, brought from Italy to compete in this year's 500-mile Memorial Day Race in Indianapolis. The car will be driven by Wilbur Shaw, who won the classic in 1937, and is said to attain a speed of better than 185 miles an hour. The one-lap record for the track is 130.492 m.p.h.



California Introduces Candid Camera "Cops"

ADOPTING the slogan "Pictures Don't Lie," the Police Department of Beverly Hills, Calif., has equipped its motorcycle and radio car officers with candid cameras, as shown at right. It is pointed out that the policemen will collect pictorial records of traffic violations to refresh the memories of careless drivers when they are hailed into court. The cameras will also be used by the officers to take pictures at the scene of a crime for use with court testimony.

Four-Foot Speedboat Model Goes 50 M.P.H.

FEATURING a specially designed hull and powered by an air-cooled engine of five horsepower, a model speedboat constructed by William G. Carter, of Chesterfield, England, is said to attain a speed of 50 m.p.h. The craft is four feet long and is confined to a circular course by a cable leading from it to a pole anchored in the center of a nearby pond.

Devise Gas Mask For Baby

DESIGNED for children under two years of age, the gas mask shown at right was developed by the British Government as part of its precautions against air raids. The helmet is slipped over the infant's head and shoulders and strapped firmly around its chest so that the headpiece is sealed from the air. A small bellows, operated by the mother's hand as shown, supplies air to the helmet. The air is chemically purified of all poisonous gases before reaching the child.

Televise Surgical Operation

THE first test of televised surgery was conducted recently at the Israel Zion Hospital in New York, N. Y. An electrically-controlled television camera was suspended above the operating table (left) and a projector set up in a room about 500 feet away (below). As the operation progressed students and doctors seated before the projection screen were able to observe every move of the surgeon's hands and to hear his explanatory comments as well. It is expected that many hospitals throughout the country will adopt the idea in the future as part of their training routine for internes and nurses.

Aircraft Windshield Wiper's Blade Rotates

DESIGNED specially for aircraft use, a new rotary-type windshield wiper (right) is said to effectively prevent the collection of rain, ice, sleet, spray or snow. Electrically operated, the wiper has a revolving blade which can be rotated at any desired speed up to 2,500 r.p.m. Anti-icing fluid is fed from a small tank to the leading edge of the wiper blade through holes in the drive shaft and is distributed, by centrifugal force, over the area swept by the blade. The flow of fluid is sufficient to eliminate ice formation at all temperatures. The insert shows the wiper, speed control knob and anti-icing fluid storage tank, respectively.

A smaller wiper of similar design is being developed for use on boats, buses, trains, etc.

Treadmill Operates Wagon

INVENTED by Harry Kister, of Philadelphia, Pa., a novel children's express wagon features a treadmill which is geared to the rear wheels. By removing the floorboard (right) and operating the treadmill by footwork action a tot can make the wagon go, the speed depending on the vigor of his footwork.

Plane Lands Like Autogiro

FEATURING specially designed flaps on the leading and trailing edges of its wing, a new twin-motored airplane is said to be able to land almost vertically. The pusher-type motors of 125 horsepower each provide a top speed of 175 m.p.h. Note the nosewheel.

100 M.P.H.

Ole Evinrude, whose dilemma for rowing was responsible for the first practical portable outboard.

Outboards—the sport of the little fellow as well as of racers and kings—have been clocked at speeds from 8 to 80. What do you think are the chances of topping 100 m.p.h. in an over-grown batter-mixer? Read the story for an answer to this question.

by Stanley Gerstin

ONE hundred roaring, splashing, thrilling miles an hour in a boat propelled by an outboard *motor* is a certainty.

Do you scoff at the idea? Well, don't. The recent progress made in powerplant development for the animated puddle-skimmers insures a speed in excess of the hundred mile-an-hour figure.

Take a look at these figures: In 1924 the first outboard motor race was won with a speed of *eight miles an hour*. Only thirteen years later Bedford Davie of Green Pond, N. J., was clocked in his outboard job at *78.12 miles-per-hour*. An increase in thirteen years of 70.12 miles per hour.

At the same rate of increase the hundred-mile-an-hour clip will be here in five years. In reality, it will be here sooner—possibly this summer.

Regattas, such as the yearly Hearst Trophy race down the Hudson from Albany to New York, are farther to outboard development. From these gruelling tests of engine and boat come the refinements in construction that today make it possible for every man to own a "pocket-size" powerhouse he can carry anywhere and attach to the hull of his fancy. A quart of gas and he can cruise with the best of 'em, throw his wake into the prow of many an expensive job with a built-in engine. With one of the larger outboards you can knife along at a roaring forty miles per hour, and the same engine that carries the family on an outing will push a canoe in wilderness waters in search of fish or big game.

There is romance in this development, as there is bound to be in an industry so young that serves so many with dependable transportation for sport or business.

Ole Evinrude, a resident of Wisconsin via Norway, is father of the industry. As legend has it, Ole was courting a certain Bess Cary,

With An Outboard!

From a low of 8 m.p.h. in 1924 the speed of outboards has been stepped-up to 80. The speed is spectacular and the racers have learned to love the feel of the wind tearing at the face and the bitter sting of flying spray. Right: The start of the race is almost as exciting as the race itself with the drivers busy warming their snarling motors.

and had rowed her for the day to an island several miles from shore. The young lady thought ice cream would be a distinct contribution to their picnic lunch, so gallant Ole jumped into his skiff and churned the oars back to the mainland in a long, warm, row.

But on the slow trip back the ice cream melted. Ole Evinrude was a man of action. First, he married the young lady. Then he developed a motor to take the place of oars—the outboard as we know it today.

True enough, Evinrude's wasn't the first outboard. There is a record of such an engine developed by Edward Savage in 1898, and in 1906 a detachable rowboat motor was already on the market. But Ole Evinrude did build the first model that was practical and one that could be depended on—part of the time, anyway.

It took Ole two years to develop his motor. It was nothing spectacular and operated on

A dinky little boat going 45 miles an hour and leaping clear into the air everytime it hits a high wave looks exciting. This Johnson-powered outboard pushing its way to victory in an early Albany-New [illegible] as it leaped clear of water.

The outboard has been used for some strange purposes besides powering boats. This is one of them. The outboard-powered sea plane leaps clear of the water, then settles down with a smack. No harm . . . lots of fun for all.

The above drawing shows a cutaway view of a modern, medium powered outboard. Note how similar it is to the original motor (left) built by Evinrude.

the same principle as previous models. The visible difference between the Porto model then on the market and Ole's was the placement of the single-cylinder engine parallel with the drive shaft in the Porto job, while Evinrude's motor was mounted above and at right angles to the shaft—exactly where it is today. Evinrude's was also a better engineering job. Such refinements as adding more cylinders, designing the cord pull, stepping up the horsepower while reducing the weight per horsepower and introducing the underwater exhaust have since been made. But a comparison of the early model with the latest engines illustrated with this article will show that the basic design still remains.

The story goes that having perfected his motor, that was that. But such was not the attitude of the girl-who-wanted-the-ice-cream—by now Mrs. Evinrude. One night she sat down in the kitchen and wrote an advertisement which read, "Don't Row! Throw Away the Oars! Use an Evinrude Motor." Result was that Ole Evinrude was in business before he knew it and by 1912 was shipping several thousand outboards a year.

The outboard fad swept the country by storm and shortly thereafter Evinrude was able to sell out for $150,000. That was a nice windfall for this unassuming inventor who didn't like to blister his hands on a pair of oar handles. Evinrude took life easy for a few years thereafter, but by 1919, he again had the urge and again locked himself up in a room to tinker with an engine.

This time he emerged with the Evinrude light-twin outboard which he called the Elto. It was the first light two-cylinder outboard on the market and was a decided advance over other models. It developed three horsepower compared to the two developed by the original Evinrude motor, yet it weighed only 40 pounds, which was 27 pounds less than the earlier model. Evinrude thus created quite a stir in the outboard market by offering the public more horsepower in a light engine. He accomplished this by using aluminum alloys instead of brass and iron wherever possible.

In the meantime, while Evinrude was riding to glory on the Elto, the Johnson Motor Company, South Bend, Indiana, launched a highclass outboard heavy in weight and high in price but it had something none of the others could offer. It had speed! For once the public began to realize that they could get places fast, not just get there, and they

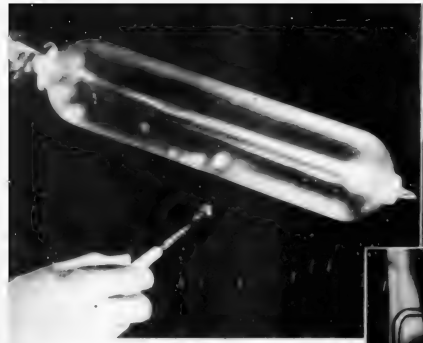
began going for the bigger engine in a big way. The speed fad soon found its niche as a racing sport and the general public eventually settled back to its 10-mile-an-hour put-put, but the larger and faster motor did serve the purpose of making the world more aware of outboards as a convenience as well as demons of speed. The speed was spectacular, it was glorious, it was a new thrill and the public learned to love the feel of the wind tearing at the face and the bitter sting of flying spray. A dinky little boat going 45 miles an hour and leaping six feet in the air everytime it hit a high wave looked exciting and got itself talked about. This was a forerunner of the greater speeds yet to come. By this time Evinrude had produced an outboard that traveled 35 miles an hour to match the Johnson job and everybody was happily bobbing over the water at a terrific rate.

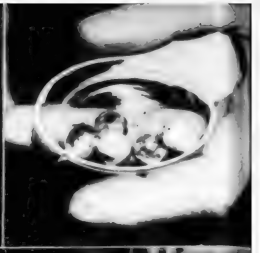
A few years later the Johnson, Elto and Evinrude companies merged and the Outboard, Marine and Manufacturing Co. was born. There are other companies such as Bendix, Champion, Muncie Gear Works, etc., but the Outboard, Marine and Manufacturing Co. sells 60 per cent of the market and the chances are two to one you are toting an Elto or Evinrude motor under your arm. Today it is estimated that there are half a million outboards in use.

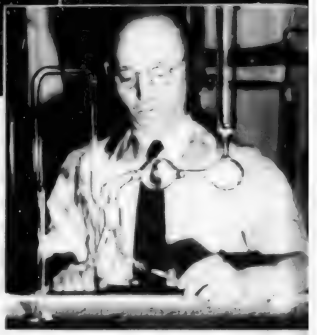
During these years of development, the outboard, like the automobile, became lighter, faster, stronger—and cheaper. Improvements have been made in all the models with special features in some, such as the reversing arrangement in the Johnson motor. Latest news of all is the development of a nine pound motor selling for $29.50 which will turn up a half horsepower and drive a full-size boat

[*Continued on page 91*]

A variation of the version on the opposite page is this waterplane (right) attached to a boat powered by an outboard. As the boat gains speed, the air current lifts the plane above water for a precarious thrill. *Below:* The same engine that carries the family on an outing will push a rowboat or canoe on a fishing or hunting trip. "Outboard" means pleasure for all alike.







Sodium "Bombed" Into Lamp

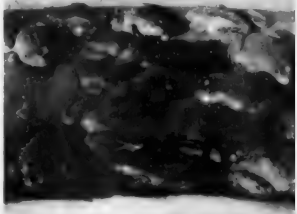
GETTING a pinch of sodium into a sodium vapor lamp, a type which is becoming increasingly common in highway lighting, is a complex problem involving the introduction of about 1/80th of an ounce inside the vacuum tube without exposing the sodium to the air. Engineers have solved the problem through use of tiny glass "bombs" (right, upper) in which the sodium is deposited after an intricate distillation process (right), a dozen "bombs" being produced at one time, as indicated by technician's pencil. After the sodium "bomb" has been placed in the lamp tube and the tube has been evacuated, a high frequency coil is placed around the tube. This coil induces heat in any metal within the tube, causes the sodium to melt, to heat still further to the boiling point and, finally, to explode its glass "bomb." The sodium is deposited against the walls of the lamp and since the shattered pieces of the glass "bomb" are hardly more than dust, they can be left in the lamp without impairing its efficiency. Size comparison of a lamp and a sodium "bomb" is shown in upper photo.

Curtiss Dive-Bomber Adopted By U. S. Navy

DESIGNED to operate off an aircraft carrier, the fast maneuverable Curtiss SBC-4 Dive-Bomber shown here is the latest addition to the U. S. Naval Air Service. Performance and armament data is being held secret by the Navy. Note the completely retracted wheels of the landing gear which fit snugly into wells built into the smooth sides of the streamlined aircraft's fuselage.

Above—A bullfrog tank farm. Each tank is 16 feet in diameter and holds 1,000 frogs.

Tanks Simplify Bullfrog Culture

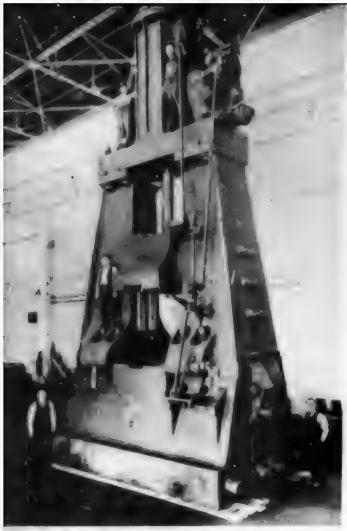


COMPLETE protection against all natural enemies, perpetual shade, adequate feeding, abolition of cannibalism, elimination of red leg frog disease, ideal temperature control, confinement of frogs to the domestic range, greatly reduced mortality and a growing time of seven months from baby frogs to marketable maturity are some of the many advantages claimed for a patented system of frog culture in concrete tanks developed by John Eugene Stearns of El Monte, California.

In 1932, Stearns began experimenting with the idea of raising frogs in concrete tanks, 4-feet deep and 16 feet in diameter, 1,000 frogs to each tank. The first year proved the basic success of his plan; he raised 4,000 out of 5,000 frogs placed in a series of 5 tanks—a mortality of only 20 per cent. By 1937 he

[*Continued on page 102*]

Right—Inside one of the frog tanks, showing the concrete lip on which the frogs spend most of their time. The man is indicating the 2-inch-high flange which marks the normal water level maintained in tank. Center—Imagine what happens when 100 pounds of earthworms, crayfish, etc., are placed in the lip with 1,000 "big fellows" like these.



Biggest Steam Drop Hammer

STANDING 27 feet high from the floor line to the top of its cylinder, the steam powered drop hammer shown above weighs more than 70,000 pounds and exerts a pressure of about one million pounds. Installed in an English factory, the mammoth machine is used in the manufacturing of large aluminum alloy airplane propellers.

"Robot Man" Has Glass Body

PLACED on exhibition at the San Francisco Golden Gate Exposition, a newly developed "mechanical man" features a body made of plate glass, revealing an intricate maze of cogs, gears, wheels, levers, etc., to public gaze. Employing a microphone which it holds to its mouth, the robot answers numerous questions put to it by means of a dial device, as demonstrated by the young lady (above). Two years were required to build the intricate robot machine.

Machine Facilitates Making Of Relief Maps

DEVELOPED by John Braund, cartographer for the U. S. Coast and Geodetic Survey, a new electrically-powered machine facilitates the making of relief maps. A thin metal, upon which a map is printed, is placed in the machine and a hand-guided electric hammer then hammers out the topographical details in a true-to-nature manner.

Crewless U. S. Lightship Controlled By Radio

ANCHORED in the ship channel of Lake St. Clair in Michigan and equipped with lights, fog horns, and a radio beacon for the guidance of ships in heavy fogs, the United States Lighthouse Service lightship *St. Clair* (right) has no crew, being operated by radio control from a land station about eight miles away (right, center). The control apparatus is entirely automatic so that the operator at the shore station need only press a button to start all the fog warning devices aboard the ship functioning. To insure against a breakdown, all control circuits are in duplicate, each controlling a complete set of navigational aids on the lightship. After pressing the button the shore attendant hears, via radiophone, the noise of the machines aboard the ship, thus checking their operation. He hears not only the power machinery and air compressors, but also each blast of the distant ship's fog horn and bell as long as the equipment is in operation.

Device Demonstrates Shaving Technique

USED to demonstrate the technique of modern electric shaving to spectators at the New York World's Fair, a novel device (right) picks up the reflection of a man shaving before a small mirror, projects it through a series of magnifying lenses to a series of mirrors and finally flashes the image, greatly magnified, onto a transparent screen where it is seen in motion and in natural color. Known as a Magnascope, the device was invented by William Herrschaft, an illuminating engineer, for display use by a well known electric shaver manufacturer.

PLASTICS—

Lucite, a transparent plastic developed by duPont, is shown being polished at the factory (left). One example of the application of transparent plastic is shown above. As lenses for glasses, binoculars and similar equipment, plastics pioneer a new field.

THE plastics industry crept up on the United States during panicky depression years. Now that things have calmed down, people have time to look around a bit—and everywhere they look, they see hundreds of plastic-made objects. The moldable rivals of metal, lumber, china, and such materials that go into the making of objects for your home and office, are all around you in various forms, including everything from combs to salt shakers. Jewelry using plastics is to be found in Tiffany's as well as Woolworth's. The old-fashioned bar with its wooden surface and brass rail is giving way to stylish bars made with a brilliant array of colored plastics. John D. Rockefeller has plastic-made panels for the bathrooms of one of his homes, and the great ocean liner the *Queen Mary* uses about $100,000 worth of the new industry's best wares.

But Celluloid and cellulose acetates—the substances described in the previous article are by no means the only plastics used for these and many other purposes. The cellulose-containing materials are made from wood or cotton wastes and are examples of the so-called vegetable plastics. The field, however, also includes the mineral plastics, substances built from simple chemicals found in coal tar and in the air. Among these is the famous Bakelite, and the story of its finding makes one of the most interesting chapters in the history of synthetic chemistry.

Leo Baekeland was a promising student at the University of Ghent in Belgium. He had entered the institution in 1878 at the age of fifteen and when he graduated, became a chemistry professor. Young Baekeland wasn't interested in the industrial application of his science, and would probably have been contented to teach would-be chemists for the rest of his life, had it not been for an unforeseen event. He fell in love with the daughter of another professor. No sooner was he married than he found two couldn't live as cheaply as one. To support his wife the young man was forced to desert the classroom and devote his energies to solving the chemical problems of manufacturers.

Then in 1889 Dr. Baekeland did a bold thing. He left Belgium, went to the United States, and settled in Yonkers, N. Y. There in a small laboratory he performed many research tricks. His best bet at first, however, was a new kind of photographic paper called Velox, and he was just about to manufacture it on a large scale when the financial panic of 1893 ruined everything. For the next few years Dr. Baekeland had to endure a heart-breaking series of setbacks. Not only did he fall heavily into debt, but his health began to go back on him. Furthermore, the sick inventor was receiving complaints that his photographic paper was worthless. Careless

Modern Marvel of Science

by John E. Pfeiffer

Science has learned the secret of converting natural gas, milk, acetates, ammonia and waste materials into useful products that enrich our lives. This is the third article of a series revealing their laboratory magic.

Above: Dr. Leo Hendrik Baekeland, who pioneered in the field of synthetic chemistry and developed the famous Bakelite for a thousand uses. Right: Light can be piped through crystal-clear Lucite, which bends light as shown in this laboratory photo.

customers blamed their failures on everything but their own ignorance. Finally, Dr. Baekeland decided it was too much trouble to manufacture Velox and at the same time teach buyers how to use it. One day he left Yonkers, traveled to Rochester, N. Y., and had a heart-to-heart talk with George Eastman, founder of the Eastman Kodak Company. What happened isn't exactly known, but Eastman bought the young inventor's paper, and the story is that Velox netted Baekeland a cool $1,000,000.

Whatever the actual amount transacted, it was enough to free Dr. Baekeland of the shackles of poverty, and give him time for other research. His struggle to live happily was over, but his greatest triumph was yet to come. In 1908 the great chemist was no longer a young man. But at the age of 45 he was more active than ever and hot on the trail of a new varnish. One day he mixed common carbolic acid (phenol) with formaldehyde—a substance that stimulates plant growth. Then he heated the thick soup to about 400 degrees Fahrenheit. When the liquid cooled, it became hard and amberlike; furthermore, no amount of re-heating would cause the newly discovered phenolic material to get soft again —it was "thermosetting."

Chemically speaking, the plastic's proper name was "Oxybenzyl-methylenglycolanhydride," but that tongue-twister would never do! Dr. Baekeland gave it the commercial

If you are wondering what that crystal clear plastic used for lenses and to bend light looks like in raw form, take a peek at the white powder-like substance in the picture above. It is crude methyl methacrylate polymer! No wonder duPont calls this material "Lucite" for short.

Stamped under high pressure, thousands of Bakelite radio cabinets are turned out by pressure machines like that shown at right.

nickname of Bakelite and proceeded to put it on the market. Years of bitter experience had taught the inventor an infallible lesson: "One of the evidences of a successful patent is infringement." And Bakelite was no exception. Dr. Baekeland had to protect his phenol product from many imitators; he went through a flock of patent suits and won every one of them. The one-time professor had turned into a rare combination of top-notch inventor and shrewd business man.

If Bakelite is to be shaped by high-pressure methods or iniected into forming molds, it is not allowed to become solid, but is ground into a powder before the hard, thermosetting stage. Or it may be poured in a lava-like stream into special molds and allowed to harden for a few days. Whatever the way manufacturers use to solidify Bakelite, however, it usually ends up with rich, lustrous dark colors—black, brown, mahogany, walnut. It can be treated in a host of ways—asbestos can be added to increase its heat resistance, mica and graphite affects its electrical properties. Bakelite may be undamaged by temperature as high as 450 degrees Fahrenheit (lead melts at 327 degrees), and is a handy material for heating plugs, cooking-utensil handles, distributor heads in automobile engines, and permanent wave machine parts. Properly treated the phenolic plastic may be able to resist practically any amount of wear and tear. Football cleats are often made of Bakelite, as are silent gears for machinery. The mouthpieces and receivers of more than 17,000,000 telephones are constructed out of Dr. Baekeland's top-notch money-making discovery. In 1926 his basic patents expired, and a host of other phenolic plastics were made. Besides the Bakelite Corp. in Bloomfield, N. J., leading companies and their phenolic plastics include the Catalin Corp. N. Y. (Catalin), General Plastics Inc., N. Y. (Durez), and many others.

But there is a fly in every ointment. The catch in the case of Bakelite, for example, is that it can't be made in bright colors or white. In 1928 the Toledo Scale Co. needed a plastic with the latter color. Butchers' scales must be white. Actual tests show housewives associate white so strongly with cleanliness that they won't buy meat weighed on scales with other colors. So the Toledo Co. had to coat its cast-iron scales with gleaming white enamel, which often chipped and was an expensive process. Moreover, Toledo salesmen

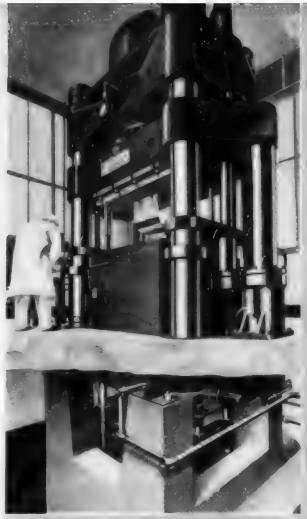
The comb and frame for the mirror are made from crystal-clear Bakelite polystyrene. A thousand-and-one practical uses are being found for this new material. Its availability has resulted in the invention of dozens of new items not previously manufactured because of high material and production costs.

had to be small-scale Sandows, for some of their best scales weighed 165 pounds or more. What was needed was a permanently white material, lighter than cast-iron and as strong.

To find this substance the Toledo Scales Co. financed research work at Pittsburgh's Mellon Institute. In two years the job was done. The new plastic came neither from plant matter nor coal tar—it was made from gases in the air. Liquid ammonia—made with the air's nitrogen—is mixed with the gas you exhale, carbon dioxide, also in a fluid form. The result is *urea*, a white crystalline substance which is made on a commercial basis only at duPont's Charleston, W. Va., plant. By properly mixing carbon monoxide (the automobile exhaust gas) with hydrogen, methyl or wood alcohol can be synthesized, and this liquid is mixed with plain oxygen to get *formaldehyde* (also used in Bakelite). When a special urea-formaldehyde combination hardens, it becomes a plastic which takes a beautiful clean white color. Squeeze the material at pressures from 1,500 to 6,000 pounds a square inch and out come new-style scale parts. The Toledo scales that once weighed 165 pounds now weigh one-third that figure, and the urea-formaldehyde plastic is strong and durable.

As a result of this work the Toledo Scales Co. started the Toledo Synthetic Products Co., which manufactures the urea-containing plastic as Plaskon (another company manufacturing such plastics is the Beetle Products

[*Continued on page 87*]



The tremendous press shown above is needed to stamp the Plaskon (white plastic) housing for the Toledo scale shown below. The press is 30 ft. high and in operation applies 3,000,000 lbs. pressure.

"Making Faces" For Fun

Life or death masks of historical personages like Lincoln, Napoleon, Beethoven, etc., are invariably hollow-cheeked which is due, mainly, to the type of material used to make a mold of the face. However, a new method of making life masks which has been developed as a hobby by Steven Clenson, of Hollywood, Calif., is said to overcome this trouble, providing masks that are perfect reproductions of the subject's features. In the photo at left, Mr. Clenson is shown starting to make a mask. The subject's face is covered with a semi-liquid compound that prevents the fine hairs of the face from adhering to the mold proper as the mask is developed. A compressed air spray machine is then used (below) to apply a second semi-liquid base to face and hair. This base is soft enough to let the hair free, yet it retains the general contour of the hair waves, adding realism to the mask when completed.

After a third base, which resembles peanut brittle in consistency, has been applied to the subject's face and allowed to dry, the resultant mold is carefully lifted from the face and filled with a plaster mixture. When the plaster has hardened, the mold is loosened and the mask removed (above). After being colored with life-like oil tints, the mask is held beside the subject's head (right) so that its quality of reproduction can be studied. (The angle at which the photo was taken makes it appear as though the mask is smaller than the subject's face). Mr. Clenson has not revealed the composition of the materials used in his spray process.

Apparatus Recreates Earthquake For Study

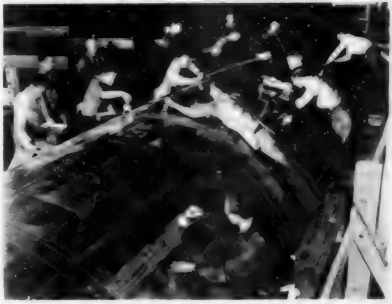
FROM measurements made on the scene and recorded at several seismograph stations in California, motions of the earthquake which shook the southern section of the state six years ago are reproduced by the apparatus shown at right. From a study of the resultant strains and stresses reproduced by the sensitive apparatus, engineers hope to make practical recommendations for constructing buildings which will be earthquake-proof.

Devises New Portable Radio For Expeditions

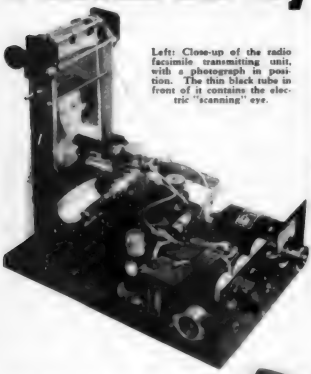
DESIGNED specially for use by expeditions traveling in remote areas, a portable short wave radio transmitting and receiving set developed by Thomas S. McCaleb (center), instructor of radio at the Harvard School of Geographical Exploration in Cambridge, Mass., weighs only 50 pounds and is capable of reliable two-way communication over a distance of 500 miles. The transmitter has an output of between 10 and 15 watts.

Stratoliners' "Skin" Tested For Air Leaks

TO DETERMINE if the joints are properly sealed, the seams in the all-metal fuselages of "stratoliners" being built at the Boeing Aircraft plant in Seattle, Wash., are covered with a soap film, as shown here. Mechanically created air pressure, similar to that which will be built up within the fuselages in substratosphere flight, causes the film to bubble along the seam if a leak has developed during the construction process.



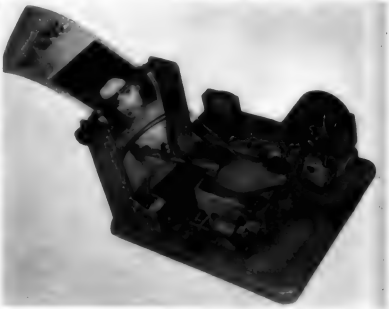
Pictures by Radio



Left: Close-up of the radio facsimile transmitting unit, with a photograph in position. The thin black tube in front of it contains the electric "scanning" eye.

The "Readio" facsimile receiver is a regular broadcast set with the printing apparatus included inconspicuously inside the cabinet. The printed paper issues from a slot in the side.

Right: This is the facsimile printing unit in the receiver, with a nearly-completed picture on the roll. The operation is entirely automatic; the set owner must merely be certain the roll of paper is properly inserted.



RADIO facsimile, the process by which pictures and printed matter are transmitted over the air for identical reproduction at the receiving end, is rapidly advancing as a new and valuable service of radio broadcasting. An experimental facsimile network has been established as part of the Mutual Broadcasting System, and already three important stations, WGN, WOR and WLW, are transmitting on regular schedule. Factory-made receivers of medium price are being produced by a large radio set manufacturer and are now advertised and sold by department stores.

At the present time, the transmissions are made on the station's regular frequency between one and six o'clock in the morning. The receiver is controlled by a time clock, which turns it on at the right time, allows it to perform its printing operations, and then turns it off, leaving a permanent record on a long roll of paper. The apparatus produces about three feet of 4½-inch wide paper per hour.

The entire facsimile process is easy to understand. The broadcasting station is equipped with a device for "scanning" or visualizing the picture or other printed matter, just as it uses a microphone for translating sound programs into electrical impulses. The visualizer consists of an electric eye which moves back and forth rapidly across

[*Continued on page* 111]

Aerial Gunners Train With Ground Targets

STANDING in a wooden frame to which is fixed a revolving machine gun, a recruit of the Royal Air Force (England) is shown learning to keep his weapon aimed on a moving target by following the evolutions of a model airplane mounted on a stick held by another student airman. This ground method of teaching aerial gunnery is used by the air forces of practically all the nations as a prelude to actual air work.

Compact Television Unit Demonstrated

DEVELOPED by a well known radio firm, a new portable television transmitter unit stands only five feet high and about two and one-half feet wide. In a recent demonstration, the transmitter was sighted on a golfer teeing off (right) and the images were picked up by a television receiver housed in a small tent erected at a point about 150 feet away from the site where the transmitter was being operated.

Screen Helps Yankee Pitchers "Play Ball"

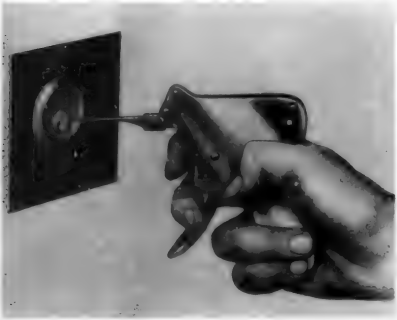
USED at the spring training camp of the New York Yankees baseball team in St. Petersburg, Fla., the novel pitching screen shown at right helps the team's pitchers acquire proficiency in throwing baseballs to a batter. The screen features five holes which are placed at points indicating high, low and perfect pitches and the players seek to "call their shots" by hurling the balls through the holes selected and named before throwing.

Pain-Indicator Aids Patient

OPERATED by a rubber bulb held in the patient's hand, a novel "pain-indicator" invented by Dr. Thomas L. Marsh, a dentist, enables a patient to inform the dental surgeon if he feels pain during a treatment without requiring him to speak. Upon feeling pain the patient squeezes the bulb in his hand, causing a chime on the wall to ring.

Makes Big Candid Camera

USING the back of an old view camera, the front of an old reflex camera, the finder from a Speed Graphic and the range finder from a Leica, Fred R. Jolly, of Peoria, Ill., has assembled what is believed to be the largest candid camera in existence, taking an 8x10 negative. The novel camera is equipped with a synchronized flash and the synchronizer is used to trip the shutter at all times, whether the flash is used or not.



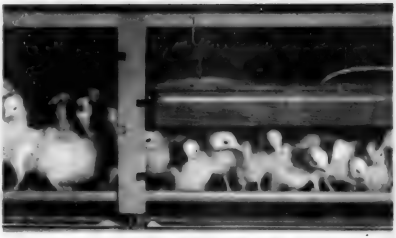
Lock-Picker Device Resembles Revolver

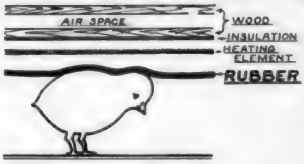
SHAPED in the form of a revolver, the automatic device shown at left is said to be so efficient in picking locks that a famous lock inventor has requested the police commissioners of many cities to regulate their sale and use. In place of a barrel, the revolver-type device has a steel needle which is inserted in the keyway of a lock. A pull of the trigger actuates the needle, manipulating the pins in the lock and causing it to open as easily as though a key has been used.

Short-Haul Locomotive Travels Rail Or Road

DESIGNED for short-haul and switching purposes a newly developed locomotive is fitted with rubber tires and small flanged steel guide-wheels, enabling it to haul freight cars over rails or trailer-trucks along highways. By merely touching a lever, the operator can retract the steel guide-wheels so that the locomotive travels over the highway on the tires alone. Powered by a 125-horsepower gasoline engine, the locomotive can speed at 55 m.p.h. and has enough power to haul four fully loaded freight cars or eight empty ones.

Rubber "Hen" Warms Backs of Baby Chicks





AN ILLINOIS firm has developed a new type of brooder which, instead of heating the air in the conventional manner of most brooders, takes the more natural method of warming the backs of the young chicks just as if they were snuggling under the warm breast of their mother. As shown in photo and sketch, the young chicks' backs touch an electrically heated rubber pad, the surface of which has a thermostatically-controlled temperature of 105 degrees Fahrenheit equalling that of the mother hen's breast.

Believe Your Eyes??

CREATING an illusion of a ship which has been partly buried on land, the photo at right shows the *S. S. Bremen* passing through the Panama Canal. Grossing 51,656 tons, the *Bremen* is the largest commercial vessel to transit the canal. Her length is 898 feet, 7 inches and beam is 101 feet, 9 inches. The canal can handle any ship now afloat with exception of the *Normandie* and *Queen Mary*, which are too long for the locks.

MI Fly Electrocutor

IT IS neither difficult, expensive nor dangerous to rid your home or garden of flying insects pests by means of electricity. There are several methods of doing this, but extensive tests made by the author indicate that but one type qualifies in both safety and certainty. Insects making contact with the charged grid of either of the two alternate designs shown here will die instantly. They will *not* return to life a few minutes or hours later.

One commercial type that was examined has a grid charged with 110-volt house current in series with a 7½-volt lamp, the latter acting to limit the current to a safe value. It was found that the comparatively low voltage resulted in very slow electrocution, larger insects being able to free themselves from the grid quite easily. On the other hand, the use of 5,000 or more volts from a luminous tube transformer results in a breakdown of grid insulation on homemade jobs, and in addition such a transformer is more costly.

The MI electrocutor is activated with a small power transformer, of the type used in four-tube radios, delivering 650 volts at a safe current value of only 40 milliamperes. These cost about 75c when purchased new, and little or nothing when secured from the junk box of a friendly radio experimenter or service man. In any event, either of these insect dispatchers can be made for not much more than a dollar.

The power unit can be made so as to be adaptable to and interchangeable with either of the types of grids that will be described. In addition to the transformer you will need a 5c pie tin of 6-in. diameter, an empty 1-qt. lubricating oil can, a few bolts and a few feet of rubber-covered cord with plug.

Preserving the unopened end of the oil can, cut it down with tin snips to a length of 2 inches. It is to serve as a housing for the transformer and should fit evenly on the bottom of the pie tin, so if the cut is not even all

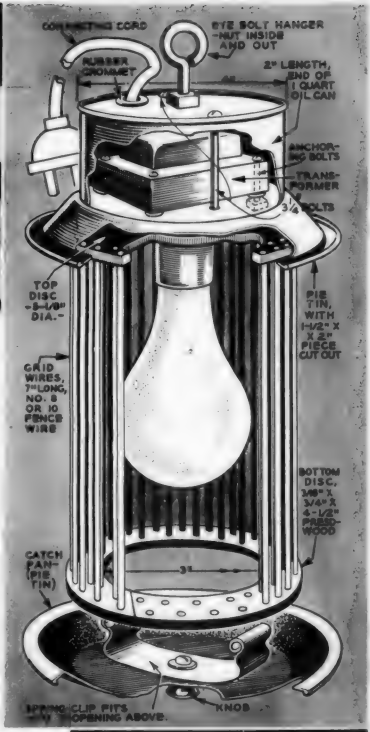
Left: The MI de luxe type lamp. Seven-inch lengths of galvanized fence wire are used for the grid; they are staggered so that casual contact with the hand will not cause a shock. Top: Catch pan is easily slipped in place or removed. It is held by two spring brass clips.

by
Kenneth Murray

First operation in making the power unit is to cut an oblong hole in the bottom of a five-cent pie tin, so that the transformer may be neatly attached.

around, hold it with even pressure against a sanding disc. Wipe excess oil from the inside and scrape off all of the label enamel from the outside. The latter operation is necessary in order to successfully apply a coating of crackle lacquer after all of the parts have been assembled.

In order to accommodate the exposed core of the transformer, cut a 1½ by 2-in. piece from the bottom of the pie tin, making sure that it is in the exact center. Exact size of the required opening may vary with the transformer, so it is well to check on this. Fit the transformer in place with the exposed core and taps passing through the opening from underneath the pie tin, then drill holes for anchoring it securely with the four bolts which also hold the transformer core laminations together. The oil can housing should then fit nicely over the transformer and onto the bottom of the pie tin. Drill two holes in the latter and in the end of the can for holding them tightly together with 3¼-in. bolts. A



At right is the partly assembled power unit, with the small radio transformer bolted to the pie tin. Part of a one-quart lubricating oil can is used for a housing. Cutaway diagram above shows dimensions and assembly details. Job should be finished in black crackle lacquer.

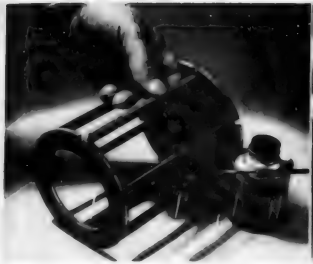
⅜-in. hole should also be made in the center of the can for an eye bolt, which serves as a hanger when the lamp is in use. Attach the bolt, which will probably have to be shortened, with a nut inside and outside of the can. The finish of the latter is improved if a disc of sheet iron or tin is cut and drilled to fit over the end of the can. The hole for the connecting cord may be made either on the end or side of the housing and should be bushed with a rubber grommet. Connection is made directly to the input of the transformer, the taps for which may be located on the accompanying diagram sheet. Ordinarily the primary or input leads will be insulated between the taps and the point where they enter the winding. Two short rubber-covered wires should also be soldered in place for feeding 110 volts to the lamp, which will be located inside the grid. Similar connecting wires should be soldered to the 650-volt taps for feeding high-voltage current to the grid.

The completed power unit, before coating with cracklo lacquer. It may be used with either of the two grids shown in the other illustrations.

If for a special reason it is desired to use a lower voltage on the grid, two other taps will supply 325 volts at 80 milliamperes. The current can also be regulated externally by connecting the transformer primary in series with the lamp; in this case, the size of the lamp will govern the strength of the grid or insect-killing current. Again, if you wish the lamp to function as a dim night light, the 110-volt lamp can be replaced with a radio pilot-light bulb which can be connected to the low-voltage taps of the transformer. However, the first wiring method is the one that is recommended as most efficient and certain of results.

When the current is turned on the transformer will give off an almost imperceptible hum. If the hum is quite audible it is due to

Holes are drilled through both Presdwood discs at once, so that they will match. A short piece of wire plugs one hole while drilling, to keep the discs in the same relative positions. Right: The wires are tapped home to make the staggered grid.



For the "regular" model, Presdwood strips are glued in slots cut in the two discs to make a cage on which the grid wire may be wound. Copper wire is soldered to the exposed ends of the grid wires so as to have two circuits. Care must be used to avoid charring the Presdwood, as this might cause a short later.

the magnetic effect of the alternating current on the metal of the power unit, particularly the bolts and nuts, and drawing up the latter tightly will stop the noise.

The grid consists of parallel wires carrying the high-voltage current, and arranged close together so that an insect making contact with two wires will instantly be electrocuted. The grid usually surrounds an insect-attracting light or else a substance, such as molasses or a bit of over-ripe fruit which offers an equal attraction. The latter is most effective with house flies.

Appearance should be taken into consideration in making the grid, and the de luxe type is most attractive from that standpoint. The wires are so staggered that an accidental brushing of the hand across the grid will not cause one to receive a shock, a feature that seems not to have been taken into consideration in the construction of commercial lamps of this type. In case inquisitive fingers do short-circuit the grid, the shock, although very unpleasant, is quite without harm. Although the voltage is the same, the amount of current delivered by the power unit is less than 1/12th that of commercial lamps.

One disc 5⅛-in. in diameter and another of 4½-in. diameter, cut from $\frac{3}{16}$-in. black tempered Presdwood, and a number of 7-in. lengths of size 8 or 10 galvanized fence wire, will be required for making the de luxe grid. On the smaller use a compass to draw two circles, one 3¼-in. in diameter, the other 3½-in. With the compass points from ¼-in. to ⅜-in. apart you can now start on one line, jump to the other and back again, alternately,

The MI "regular" type lamp, in which fine wire is wound in place to serve as the grid. Notice the neat hanger and bracket finished to match the lamp.

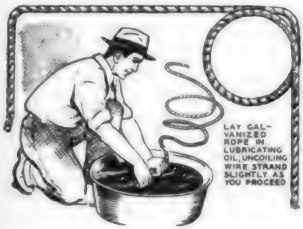
in marking points for holes into which the ends of the grid wires are to be set. The ¼-in. distance is recommended for a grid of general use, as it will place the wires so that there is a distance of about ⅛-in. between the inner and outer group.

Clamp the two discs together, in order to hold them accurately for drilling the grid-wire holes through both pieces. The holes should be small enough for a rather tight fit. Cut a 3-in. piece from the center of the smaller disc in order to be able, later, to insert the bulb inside the grid. Now tap the grid

[*Continued on page* 95]

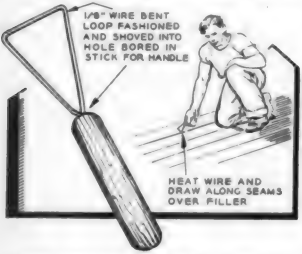
Nautical Knacks For

Rustproofing Wire Rope



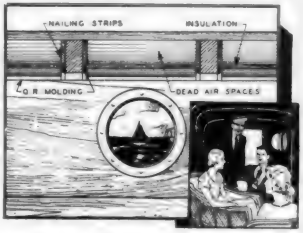
HERE is an excellent kink for prolonging the life of galvanized wire rope. Pass the rope through a bucket or pan of lubricating oil, unlaying the strands slightly as you proceed by twisting counter to the way they're coiled. The rope core will absorb the lubricant, and as the wire strands spring back into their original position they will enclose what is now an oil-soaked wick.—*B. Brownold.*

Hot Wire Irons In Seam Filler



AFTER filling deck or hull seams with seam compound run a heated iron or wire along them. This will melt the filler farther into the seams leaving the proper shallow depression. With the hot wire method you not only prevent leaks but allow the natural swelling of the wood to bring the filler out flush with the surface.—*J. Emmett.*

Insulating The Cabin Roof

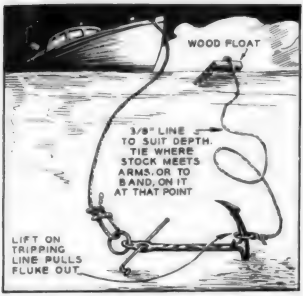


ONE of the few discomforts of summer cruising is the tendency of small boat cabins to become uncomfortably hot. This can be remedied by proper insulation, and may be done without loss of head room. Cut nailing strips from 1-in. lumber and screw them to the sides of the roof carlings 1-in. from their lower edges. One-half inch insulating board cut to the required size is nailed to the strips and the job finished off with half-inch quarter round molding screwed solidly to the carlings.—*R. A. Harris.*

Prevents Fouling Propeller

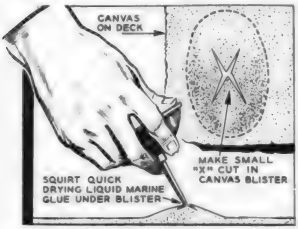
STRINGING corks on the dinghy's painter will cause the line to float when slack. Space the corks a little less than twice the distance from the surface of the water to the top of the propeller. Then if two corks come together on the surface, the loop of line between them cannot extend downward far enough to foul the propeller.—*B. Brownold.*

Yachtsmen



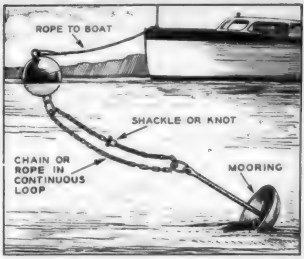
Easy Way To Handle Anchors

IF YOU have difficulty in getting up your heavy storm anchor try fitting a tripping rope to its arms. This should have a small wooden float on its upper end. To get the anchor bring the boat above it with the heavy cable, then reach over with boat hook to pull up the float. Heave on the tripping line and the anchor will break out easily.—*J. Emmett.*



Repairing Canvas Blisters

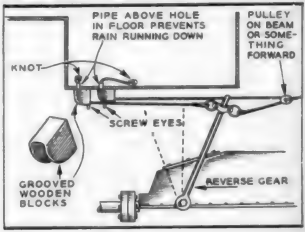
BLISTERS on a canvas-covered boat can be cured by cutting a small incision in the form of an X at the top of the blister, then squirting in a quick hardening grade of liquid marine glue. Place a smooth weight over the spot, and leave for a couple of days to set thoroughly.—*J. Emmett.*



Replacing Mooring Pennant

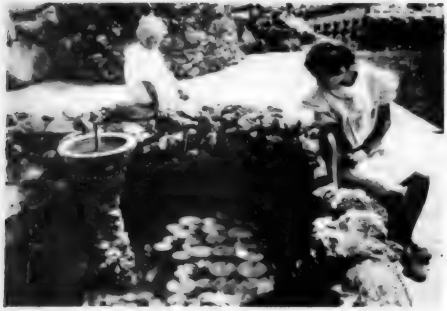
MOST moorings fail, not because the anchor drags, but because the chain or rope leading from it breaks. You can avoid having to lift your heavy mooring every year by running the rope or chain to it in a continuous loop with ends shackled or knotted together. To renew, merely pull the old pennant around until the knot is on top, unfasten it and attach an end of the new pennant to the end of the old one. Then pull on the end of the old to thread the new chain through the fitting on the anchor, bring both ends together, take off the old, and shackle or knot the ends of the new.—*J. Emmett.*

Simple Reverse Controls



IN A BOAT where the marine engine is beneath the cockpit floor, or when you wish to control it from astern, ropes may be rigged to shift the reverse gear. Pulling on the forward rope moves the engine into ahead, partially pulling on the other one into neutral, and all the way up into reverse.—*J. Emmett.*

Rock Gardens, Pools



A high wall around this pool, and a stone fountain in the center make it attractive. Lily pools are expensive if professionally built, but a few hours leisure time and some elbow grease are all you'll need to make one of these charming additions to the garden yourself.

by Paul Hadley

ROCK gardens, with their attendant lily pools, have been getting increasingly popular for the last few years, and rightly, for there are few units in a well-landscaped lawn that add as much in appearance as a well done rock garden. These decorations are expensive however, when done by a commercial nursery or landscaping concern. There is little about the making of either a rock garden or lily pool that cannot be done by the average home owner, who has a little time on his hands, combined with a small amount of artistic and mechanical ability. The accompanying photos and drawings of garden pools and their ornaments show but a few of the designs that can be easily worked up by the home craftsman.

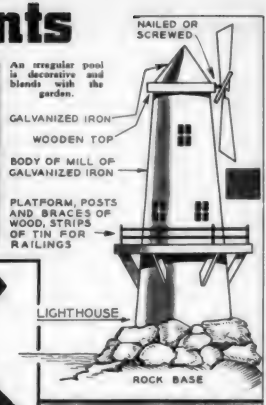
Of course, the first thing to be decided upon is the location and size of your project. As to location, any well-drained place is suitable, and the size will have to be governed by the amount of space you have available. Most rock gardens contain lily pools, though lily pools by no means always have their attendant rock gardens, and one will naturally locate his pool in a place convenient to water supply pipes, also drains by which the pool may be emptied into the sewer occasionally. Your plumber, of course, will be the best one to consult about this matter.

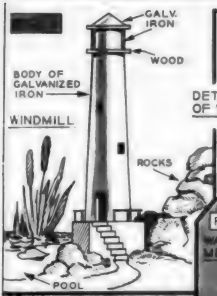
In laying off the shape of the lily pool, professional workers have found that an irregularly shaped pool looks far better than one of more regular dimensions. One effective design is shown in the overhead view, (drawing Fig. 6) with a waterfall built up in the middle. As will be seen on examination of this drawing, the rock garden part of this item is somewhat semicircular in shape, with the pool between the "arms." In selecting rocks for your garden and pool, the rougher and more uneven in size and shape you can get them the better—rocky hillsides are good places to look for them, but if these are not convenient, you may have to purchase your rock from a commercial concern.

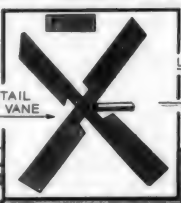
This windmill is an excellent lily pool ornament, and is easily made from wood and galvanized iron. (See drawing.)

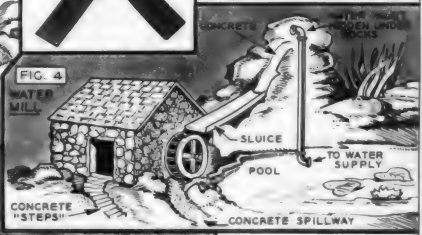
and Ornaments

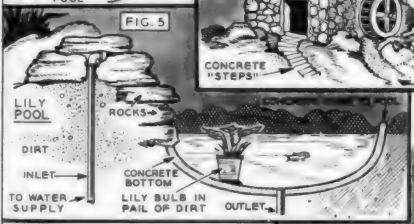
An irregular pool is decorative and blends with the garden.

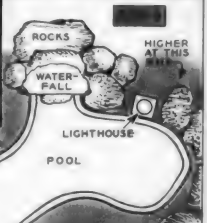


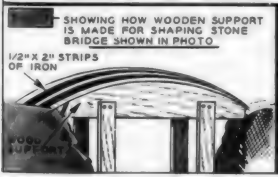












Stone bridges across garden pools lend an easily rendered artistic touch. A bridge like that above is cast in concrete on a form, which is subsequently removed. If desired, span can be braced with strip iron

A pool for grounds of limited space. Rock garden surrounds pool, and spaces between the rocks are filled with rich earth, then set with a variety of plants. Water cascades from the high rocks at one side.

A rock garden and pool suitably designed for a larger plot. The flag stones can be made by digging irregularly shaped holes in the ground about three inches deep, and filling with a rich cement mixture.

After you have laid out the shape of your pool, dig the earth out to a depth of about two feet, piling it up in a mound on the side of the pool where you intend to set the rocks. Remember that the rocks in a rock garden are set with generous spaces between them, which are filled with earth, and set with plants and shrubs. Before concreting the inside of your pool, be sure to have pipe connections made with the water supply and the drain, otherwise you will have difficulty getting them in later. Fig. 5 shows a sectional view of such a pool. The rocks, at the right are loosely set, with the water supply pipe rising between them to the top, where the water flows from the invisible pipe to form a miniature waterfall. The drain pipe in the center of the pool's bottom should be covered with wire mesh, and lead to some outlet for emptying the pool.

Ornaments, such as windmills, lighthouses, mills, etc., add greatly to the appearance of any lily pool, and these are more easily made than one might think from their extremely decorative appearance. Windmills, of stone, sheet metal, or even wood, are very popular, and one of these (Fig. 1), can be made in a short time from wood and a few scraps of galvanized iron. As the mill and other ornaments herein described will differ in size with the size of your pool, no attempt is made to give dimensions. The body of the windmill, from the rock base to the top, is made of a single piece of galvanized iron, riveted together, and with the windows and door cut through before riveting. The ringlike platform, about a third of the way from the base, is made of wood, as are the supports by which it is bolted to the iron. Post, of wood, and railings of narrow strips of the iron, add to the realistic appearance. The wooden disc at the top serves as something to fasten the mill sails to (Fig. 2) and is fastened to the iron with small screws. The cone shaped top is also fastened in this manner. The sail, or vane (Fig. 2), is of ordinary construction, and is made to turn in the wind

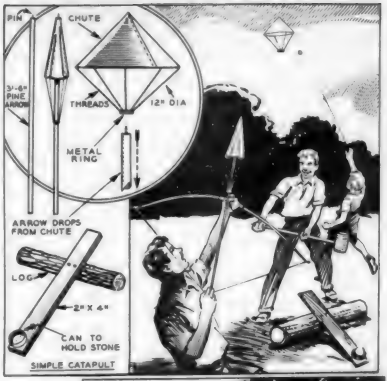
[*Continued on page* 93]

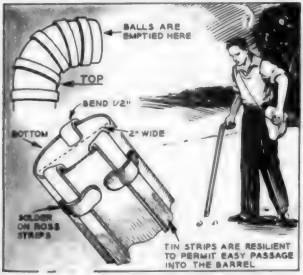
Throwing Targets

DO YOU have a good throwing arm — one that is accurate? Try it out in competition with one or two of your friends, using novel arrow parachute or catapult targets. The catapult is very easy to make and use. Nail a one-by-four board, 4 or 5-ft. long, to a small log of about 6 or 7-in. diameter and 3-ft. long, with one end of the catapult board resting upon the ground. Fasten the board to the log about 18-in. from one end, this short end to be struck with the head of an axe or sledge. To the other end tack a narrow can cover, in which a tin can will fit loosely. Place a can or rubber ball in the cover container, and strike the other end of the catapult a solid blow. The lever will throw the can or ball target high into the air, giving you a good moving target to throw at.

For the parachute target, trim out enough light cotton cloth to form a cone 12-in. in diameter at the base and about 7-in. deep. Overlap the edges ¼-in. and stitch them together. Whittle or plane down a pine arrow 3½-ft. long, notching the lower end for the bow cord and forcing a pin in the head. Clip off the pin head, leaving about ⅛-in. and file it to a point

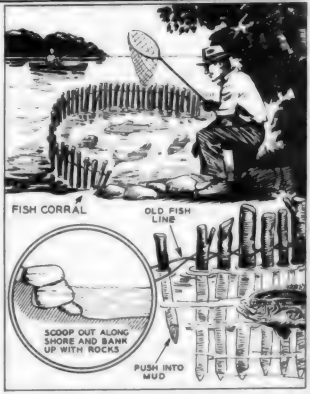
[*Continued on page 95*]





Golf Ball Retriever

AN EASY but effective way of retrieving golf balls without stooping can be made from a discarded piece of gutter pipe. This simple device is designed to hold eighteen balls and can be emptied by turning it upside down. The pipe is 2-in. in diameter and approximately 29-in. in length with an arm at the top to serve as a handle. To the bottom of the pipe are fastened three resilient tin strips that ease the balls into the barrel of the retriever. They are bent approximately a half-inch at the ends.—*James McQueeny.*



Corral For Surplus Fish

WHEN it is possible to bring the day's catch back to camp alive and you happen to have more than you need for an evening meal build this marine corral for the surplus. It is simply a fence of sticks pushed into the mud and bound together. Tops should extend a foot or two above the surface to prevent prisoners jumping out. Scoop out near the shore line and bank up with rocks.—*Hi Sibley.*

A POOL LAMP

Fitted with an appropriate shade, this pool lamp will be an attractive addition to your living room. Water plants can be grown in the miniature marine garden contained in the lamp's base, and small goldfish and snails will feel at home there.

A sharpened file tang is used to cut a groove ¼-in. deep around the rim of the base. Edge of the lead lining is then inserted in the groove when it is held firmly.

The cupped lead disc is shown below being tapped into the rim groove preparatory to the actual spinning, which presses the lining evenly down into the hollowed wood base.

DECORATING the living room table or similar appropriate place, this novelty lamp will be a constant source of interest. It digresses from the conventional in that the large base is turned hollow and is lined with spun sheet lead to make it water tight. This circular depression holds about 3 quarts of water when full and in it may be planted several types of growing things, as well as a couple of tiny gold fish, a snail or two, some moss, etc. At night particularly, the result is unusual with the light shining down from the top of the upright.

Those who feel that the upright spindle shown is too tall, can reduce the dimensions. However, the tall spindle should be used if the plants are going to be over 6 inches in height.

The first and most important step, of course, is to turn and line the base. Obtain, if possible a block of maple 12 inches square and 3 inches thick. You won't find such a piece easily, so red or figured gum may be used instead. Pine is even more readily obtainable in this size and may be finished by staining walnut or maple. Another alternative is to glue up three or four 12-inch squares 1-inch thick.

Saw out a disc 11½-in. in diameter and mount it on the lathe. You may turn this on the left-hand end if the machine has insufficient swing. Turn it to the shape shown, leaving the island in the center for obvious purposes. After cutting away wood from the inside there will be a bit of rim warping, so go back over the outside, light-turning this again to shape. Block should then measure 11¾-in. in diameter. Sand the outside well, stain and give a coat of lacquer, or about 3 coats slightly thinned, of spar varnish. Leave the inside alone.

With a sharpened file tang, cut the groove

FOR THE LIVING ROOM

by DALE VAN HORN

shown at a steep angle, about ¼-inch deep. Obtain a square of thin sheet lead from a plumber, scribe and cut out a disc 11⅛-in. in diameter, or approximately ½-in. larger in diameter than the shoulder into which the groove has been cut.

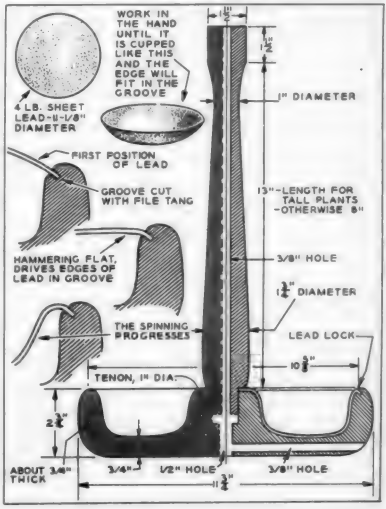
To make the edge of the sheet lead enter this groove, start to knead the lead disc, gradually working it into the shape of a huge soup bowl. Continue this until, after straightening the edges, the outside diameter of the disc has been reduced enough to let the edges enter the groove. Light hammering on a flat surface will reduce the edge thickness slightly and make the fitting easier. The purpose of this groove is to lock the rim of the disc so that it may later be spun without the edges becoming exposed.

Turn a small wood block, fit it to the tail stock center and bring it up firmly against the center of the lead disc and the center of the turning. Start the lathe at lowest speed and rub the lead with a candle or bit of hard oil for lubrication. Carefully round one end of a maple dowel ¾ or 1-inch in diameter and use this for the spinning tool, held free hand and kept continually moving slowly. With a smaller rounded dowel, rub the rim of the lead firmly to seal in the edge and watch to see that this does not come out when spinning the center. If it begins to draw out, seal again. Frequent lubrication of the lead is necessary to prevent cutting, for lead is very soft. Care must be taken that the spinning stick is not held in one place for more than an instant, else the lead at this point will be stretched too thin and break through.

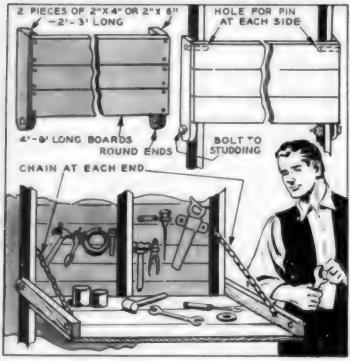
Continue the spinning until by the "feel" of the stick, you know that the lead is firmly pressed against the wood at all points. Smooth down the portion where lead and wood meet again, if necessary, then rub the lead with fine steel wool to remove all traces of grease and to brighten it. And, to keep it polished, apply a coat of spar varnish.

[*Continued on page 111*]

Above: Gleaming lead interior of the lamp base after spinning and polishing with steel wool. Cross-section drawing below shows how to do the job.

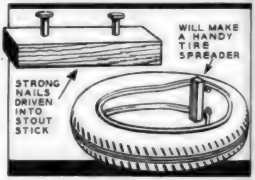


KINKS FOR CAR OWNERS



Folding Workbench For The Garage

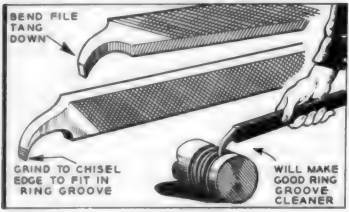
PERSONS with small garages sometimes have difficulty in finding suitable space for a workbench. The arrangement at left is a convenient one. Length of the bench depends on the spacing of the 2x4 uprights in the garage wall, to which the bench is fastened with pivot bolts, as shown. Holes should be drilled in the garage uprights to correspond with those in the outer ends of the supporting pieces. When the bench is folded up, pins run through the holes lock it in position.—*A. H. Waychoff.*



Simple Tire Spreader

DRIVE two strong nails into a husky stick at the proper distance apart. The nail heads serve to grip the tire beads firmly, spreading them apart so they won't slip.—*A. H. Waychoff.*

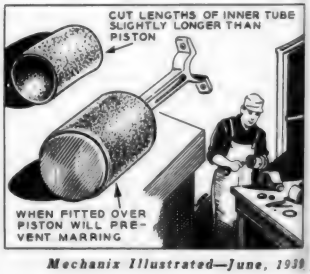
File Cleans Piston Rings



A THOROUGH cleaning job on the ring grooves of a piston can be done with an ordinary file. Bend the file tang to shape of the piston and grind to a chisel edge that will fit snugly in the grooves. With the tool thus formed you can scrape the grooves absolutely clean.—*A. H. Waychoff.*

Inner Tube Protects Pistons

PISTONS removed during an engine overhaul can be protected against accidental damage and dirt by cutting up an old inner tube in sections and slipping a section over each one.—*A. H. Waychoff.*



Minimizing Transformer Hum

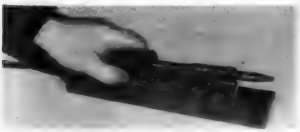
THE placement of power and audio transformers and choke coils on high-gain amplifier and receiver chassis is very important. Bad hum is invariably the result of incorrect positioning. To locate the right spots, use this method. Connect the primary of the power transformer to the power line, but leave the secondary open. Connect a pair of earphones to the terminals of the choke or to one winding of the audio transformer. Now move the unit around carefully on the chassis, turning it at all angles in relation to the power transformer until the hum is at a minimum. Mount the choke or transformer in precisely that spot. —*P. M. Ohlinger.*

Simple Code Practice Set

AN EXCELLENT code practice set for individual or group instruction can be made with an ordinary house buzzer, connected in series with a telegraph key and one or two No. 4 or 6 dry cells. To raise the pitch of the buzzer (to simulate radio signals) push a piece of matchstick or a small wad of paper between the armature and the contact spring.

Nails Support Hot Iron

A SOLDERING iron support that is fully as good as any of the complicated stands on the market can be made as shown in the photograph below. Cut a piece of scrap wood about three inches wide and as long as the iron itself. A short distance from one end, drive in two large finishing nails (or common nails with their heads sawed off) so that they form an X to hold tip of iron.

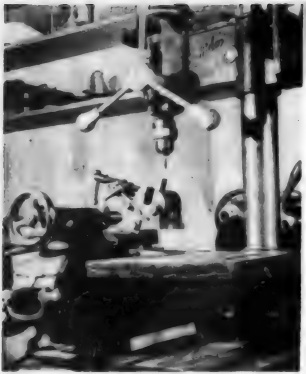


Dentist's Mirror Is Useful

A SMALL, round mirror, of the type dentists use to inspect inaccessible teeth, enable the radio technician to see into the "rat's nests" inside a radio chassis with a minimum of disconnection of parts. A pocket flashlight furnishes the needed illumination in dark corners. Real dental mirrors of this kind are expensive, but cheap counterparts, which are satisfactory for radio servicing purposes, are sold in drug, department and chain stores for about twenty-five cents.

Lettering On Panels

NEAT lettering on radio panels can be done with an ordinary set of removable rubber-stamp letters of the kind that fits in a wooden holder. Clean the panel carefully with turpentine to remove grease and finger marks; otherwise the impression will not stick. Instead of ordinary stamp ink, use a small quantity of any good enamel and pour it on a piece of wrapping paper. Fold the paper together, so that the enamel spreads out in a thin coat. Wet the rubber stamp on this paper as you would on a stamp pad, and then carefully make the impression on the panel.



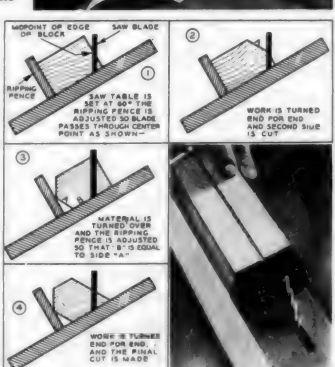
Aids For

Carborundum Grinder For Sanding

YOUR carborundum grinder can be converted in a few minutes to a sanding and polishing wheel which is ideal for small objects. Sandpaper or emery cloth is cut into discs and fitted to grinder shaft, against the wheel. Discs are held in place by nut and washer. A slight increase in sanding surface may be obtained by fitting to the shaft a wooden wheel of the maximum diameter which the grinder will handle. For polishing use a disc of felt cut from an old hat and a compound of pumice powder and linseed oil. —*E. R. Augustin, Jr.*

Vertical Milling Machine

ANYONE possessing a bench lathe, drill press and a drill press vise, has all the essential parts for a practical vertical milling machine. The only machine work necessary is to drill a hole in the base of the drill press vise, and make a tee head bolt to fit tool post side. Drill press is placed in back and at the end of the lathe; it then can be swung over the ways of the lathe for milling or back to its original position for drilling. The drill chuck will take any end mill up to ½ inch. Five movements are possible: (1) Longitudinal feed. (2) Cross feed. (3) Angular feed on compound. (4) Vertical angular milling with adjustable vise. (5) Depth of cut by stop on drill press.—*Walter Dabold.*



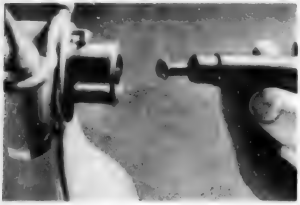
Cutting Hexagon Shaped Pieces

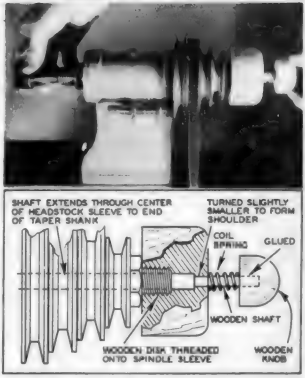
THE cutting of six sided pieces of wood is an operation that causes much trouble. When the thickness or distance betwen sides of the finished work is known this job can be accomplished quickly by the method shown in the drawing. The thickness of the wood from which the work is shaped should be the same as the distance between sides of the hexagon.—*Howard Heydorf.*

The Workshop Fan

Screw Lengthens Shank

THE taper shanks of accessories for use in the tailstock of a lathe are often too short to allow the feed screw to force them out when the tailstock sleeve is drawn in. A wood screw placed in the end hole of the shank will usually make up the lacking distance. Add washers if needed.—*Howard Heydorf.*



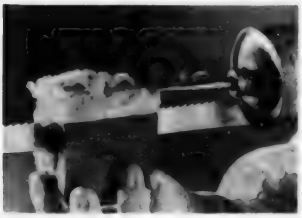


Soap For Nails In Hammer Handle

A HANDY place to keep the soap used for lubricating nails that are driven into hard-wood is in the end of the wooden handle of the hammer. A hole is bored in the end to a depth of about one inch and one-half. The soap is then melted and poured into the hole where it is always at hand when needed.—*Howard Heydrof.*

Device Removes Lathe Centers

TAPER shanks of centers may be quickly removed from the spindle hole in the lathe headstock with the jig shown. All of the parts may be easily shaped on the lathe and when assembled a tap of the hand on the wooden knob loosens the shank of the center. Large disk makes an excellent hand wheel for stopping the lathe. It may be easily removed from the spindle for working long rods through the headstock.—*Howard Heydorf.*



Block Oils Band Saw Blades

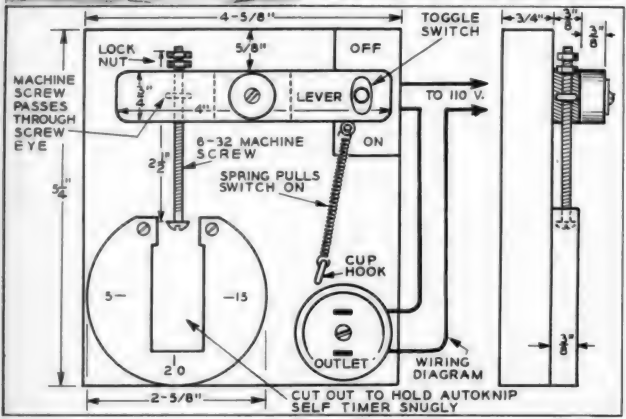
TO PREVENT rust, band saw blades should be well covered with oil after removal from the machine. This may be quickly done with the notched block shown here. A piece of sheepskin is tacked in the notch. The skin is well oiled and the blade passed through it. Block should be moved in the same direction as the teeth.—*Howard Heydorf.*

AUTOMATIC ENLARGER

Left: The Autoknip Self Timer is set to the number of seconds required and released. After correct exposure the light is turned off when the self timer pulls the switch.

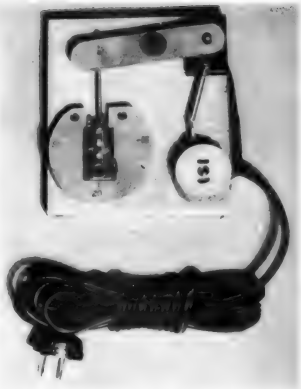
OF THE numerous methods of timing enlarger exposures employed by amateurs and professionals alike, which one do you use? Do you strain your ears to count the ticks of a watch, or your eyes to see the second hand go round, or do you just guess at the time with that certain "feel" with which some amateurs think they are endowed?

Well, all that is done with. You can now build a timing device right into your switch, which will automatically turn off the enlarger light after a given number of seconds. The timing device is an Autoknip Self Timer which can be bought at any photo dealer. A smooth working toggle switch and an outlet are also needed. The toggle switch is fitted into the upper right hand corner of a ¾-in. thick rectangle of wood measuring 4⅝x5¼-in. Its position should be such that it is OFF when pushed upward and ON when pulled down. A ¾-in. thick wooden lever, 4-in. long ¾-in. wide, has a hole drilled through one end which fits loosely over the toggle switch. Its pivot center is raised on a ⅜-in. block of wood, as shown, and a small screw eye is



SWITCH

Below: Self Timer fits snugly into cut out in the circle. Cable release arm hooks under head of the machine screw.



The Self Timer in place. Spring attached to lever pulls the switch on when timer is set. Enlarger plugs into the outlet.

screwed to the other end on its under side. A 2½-in. long, 6/32 machine screw passes vertically through this screw eye and two small nuts are attached to its end for adjustment.

From ⅜-in. wood, cut a 2⅝-in. diameter circle, the center of which, cut out as shown in the drawing, to provide a snug fit for the Autoknip unit. This circle of wood is screwed to the lower left hand corner of wood base. The self timer is then hooked under the head of the machine screw and fitted into the hollow. A coil spring is attached to the toggle switch end of the lever to pull the switch on when the self timer is set, and the nuts on the machine screw are adjusted to grip the lever and turn off the switch when the self timer stops buzzing. Next, screw an electric outlet alongside the self timer and wire it in series with the toggle switch.

Calibrations are marked on the circle of wood after determining the number of seconds it takes the arm of the self timer to recede from each point.

This automatic timing switch can be attached upright to the back of the enlarger table with angle brackets, where it is easily accessible, yet unobtrusive. The enlarger is plugged into the outlet, and the rest is a matter of turning the self timer hand to the number of seconds required, then release and forget until the light goes off. Simple?

The utility of this switch does not stop with the enlarger. It can be used with a contact printer or hooked to the floodlights to time an exposure for a photograph.

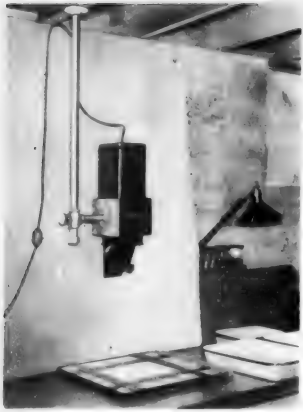
The range of adjustment of this self timer is 5 to 20 seconds. This is just about right for most enlarging operations. If a longer exposure is required for a dense negative, the unit is merely reset and released a second time.—*Louis Hochman.*

Transparencies On Paper

Regulation glass positive transparencies are costly when made in the larger sizes, but beautiful transparencies can be made on single weight contact or enlarging paper.

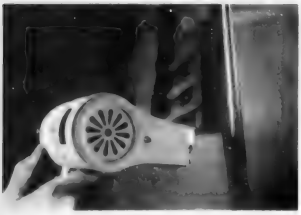
Dry the print flat and then, with a wad of cotten soaked in mineral oil, brush the back of the print and allow to stand an hour or more. Treat it with the oil a second time until when held to the light it appears actually transparent. Allow it to dry a full day.

Protect the face of the print with a sheet of clear glass bound with tape in the manner of a lantern slide. Hang it in the window and you will have a transparency of soft, translucent quality.—*L. B. Robbins.*



Ceiling Suspension Enlarger

BY SUSPENDING the enlarger up-right post from the ceiling, it is possible to swivel the enlarger in any position, sideways or up and down without interference from the post. The enlarger shown is attached to a ¾-inch pipe.

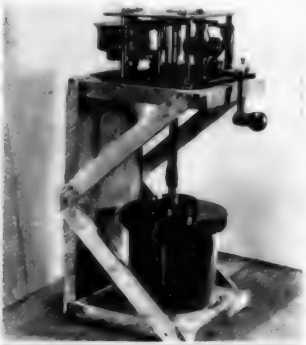


Rapid Film Drier

AN ORDINARY hair drier is handy for rapid drying of film. Total drying time is about 5 minutes when the blown heat of the drier is applied evenly over the surface of the film. The temperate heat makes it possible to use the unit at close range without harm to the film. (Watch out that dust isn't blown on film.)

High Gloss For Prints

IT IS possible to give a print a high gloss and protect it at the same time, by covering it with Cellophane. Use rubber cement. Roll down the Cellophane with a print roller to remove the excess cement and place the print under a light weight to dry.



Film Tank Agitator

AN EXCELLENT revolving agitator can be made for your film tank by converting a discarded phonograph unit as shown in the illustration. Turn motor upside-down. Attach ¼-in. rubber tubing to shaft and slip other end over agitating rod. The rubber tubing allows for flexibility. The phonograph unit in reverse position will revolve counter-clockwise—which will prevent film from unwinding on reel. Construct the stand to any desirable size.

NEW LOW PRICES ON KODAKS

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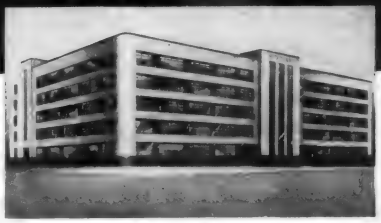

New Eastman Plant, extensive addition to camera factory already the largest in the world, as it will appear when completed. Here will be produced the finest precision cameras, made by the largest group of American craftsmen ever assembled in the photographic industry.

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Kodak Junior Six-20, Series II, Single lens	$8.75	$7.75
Kodak Junior Six-20, Series II, Bimat lens	11.00	10.00
Kodak Junior Six-16, Series II, Single lens	10.25	9.25
Kodak Junior Six-16, Series II, Bimat lens	12.75	11.50
Kodak Senior Six-20, K.A. *f*.7.7 lens	17.00	15.00
Kodak Senior Six-20, *f*.6.3 lens, Diomatic shutter	21.00	19.00
Kodak Senior Six-20, K.A. *f*.4.5 lens	28.00	25.00
Kodak Senior Six-16, K.A. *f*.7.7 lens	19.50	17.50
Kodak Senior Six-16, K.A. *f*.6.3 lens, Diomatic shutter	24.50	22.50
Kodak Senior Six-16, K.A. *f*.4.5 lens	32.00	29.00

MINIATURES	WAS	NOW
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Kodak Bantam, K.A. *f*.5.6 lens	16.50	14.00
Kodak Bantam, K.A. Special *f*.4.5 lens	27.50	22.50
Kodak 35, K.A. *f*.5.6 lens	18.50	14.50
Kodak 35, K.A. *f*.4.5 lens	29.50	24.50
Kodak 35, K.A. Special *f*.3.5 lens	39.50	33.50
Kodak Duo Six-20, Series II, K.A. *f*.3.5 lens (Compur-Rapid shutter)	57.50	52.50
Kodak Retina II, Anastigmat *f*.2.0 lens, Compur-Rapid shutter (with field case)	140.00	120.00
CINÉ-KODAKS		
Ciné-Kodak Eight, Model 20, *f*.3.5	32.50	29.50
Ciné-Kodak, Model K, *f*.1.9 (without case)	88.50	80.00

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In this department the photography editor will answer any questions or problems relating to cameras of all types, enlarging, developing, printing, taking pictures, and the various phases of home movie making. When sending questions in this department be sure to inclose a self-addressed, stamped envelope so that we can answer directly in case space does not permit answering in this page. Send inquiries to Photography Editor, MECHANIX ILLUSTRATED, 1501 Broadway, New York, N. Y.

HOT WEATHER FILM HARDENER

Q. What is a good formula for a hot weather film hardener that will protect film under the most adverse conditions?—George Simpson, Oshkosh, Wis.

A. An excellent hardener safe to use in extreme hot or moist weather is a formalin hardener. It is prepared as follows: formalin (40% formaldehyde solution) 2½ drams, sodium carbonate, 70 grains and water to make 16 ounces. Immerse the film in this solution and after hardening for three minutes, rinse negatives immediately in clear water and immerse in fresh acid fixing bath for at least five minutes. Formalin is an interesting chemical and after film has been hardened in a high concentration of it, the film may be boiled in water without injury. Such a high concentration requires one part of formalin to 8 parts of water, but when used one part to 20 or 25 parts of water, the solution is sufficient for prevention of frilling under ordinary hot weather conditions. If negatives are soaked up to 10 minutes in a weak solution after the final washing, the film emulsion will have so hardened that the surface may be patted with blotter paper and then completely dried in a few minutes before a heating unit.

CHEMICAL-PROOFING TANKS

Q. What kind of material should be used for chemical-proofing wooden tanks and developing trays?—R. P. Jeanes, M. D., Easley, S. C.

A. There are several products of an asphalt nature on the market which safely chemical-proof darkroom equipment. Among these are Kodacoat paint and Probus paint. Either one will do the job and is available from photographic supply dealers.

CORRECTING UNDER-EXPOSURES

Q. Can you tell me what to do about my film which comes out so thin that I can't print a picture from it?—R. E. Rodkey, Moraun, Pa.

A. A thin negative is the result of under-exposure and should be corrected by compensating adjustments on the camera itself. Increased exposures should be given by using a slower camera speed or a larger diaphragm opening in the lens or by a combination of both adjustments. For instance, if you shot a picture at f.11 and 1/50 of a second and the film developed too thin for practical enlarging, the next picture under similar conditions should be taken at, say, f.8 and 1/25 second. By opening the diaphragm one stop larger, you approximately double the exposure and by slowing down the speed by a half, you again double the exposure. By a combination of these adjustments, as indicated, it is possible to give four times the exposure. Keep in mind that the latitude of film is such that good pictures can be printed from negatives that have only half or even twice the normal exposure. Quadrupling the exposure as suggested here will result in printable negatives when you are suffering from extreme under-exposure habit.

STOPPING ACTION

Q. Please tell me which shutter speed will stop the most action: f.6.3 or f.32 at 1/100 second?—C. T. Hilpert, Cleveland, Ohio.

A. Shutter speeds of 1/100 of a second will stop action equally well regardless of whether the lens diaphragm is set at f.6.3 or f.32. The only difference the diaphragm will make is in the depth of focus. Naturally, the f.32 diaphragm setting will give a greater depth of focus than the f.6.3 setting.

CONTRAST PAPERS

Q. Why are there papers of different contrast and how are they used?—Wm. H. Chownes, Sparkill, New York.

A. Contrast paper is used to compensate for under or over exposed negatives. Its principle application is with the use of thin or flat negatives which give poor tone gradation and loss of detail when printed on normal or soft papers. Contrast paper compensates for the flat negative and shows greater detail in the thin areas of under-exposed negatives. Naturally, the degree of flatness or thinness of a negative determines the degree of contrast paper to use. Negatives of normal exposure or of strong contrast, that is, strong lights and darks, should be printed on soft paper to minimize the extreme contrast.

CONDENSER IN ENLARGER

Q. I am building an enlarger in which I intend using a condenser. Please advise me how close to the film to place the condenser.—C. A. Wagner, Kingston Mines, Ill.

A. The position of a condenser should be as close to the film as possible. As a matter of fact, enlargers with condensers in movable mounts are so built that the condenser comes down against the film to hold it in place. In enlargers where the position of the condenser and the negative is fixed, the clearance between the two should be just enough to allow the negative and negative holder to slide in and out of the enlarger without touching the condenser.

COPYING AT 1 TO 1 RATIO

Q. I would like to use an extension tube on my camera for copying so that I can get a 1 to 1 ratio, that is, obtain a full-size copy. How do you determine the length of the tube necessary?—J. H. Trumble, Chicago, Ill.

A. The life-size image of an object may be obtained by doubling the focal length of your lens. In other words, if the lens has a 3-inch focal length, the tube should be 6 inches. This would place the lens 6 inches from the film in the camera. By the same token, the distance between the lens and the object will be 6 inches. If you remove the back of your camera and place a ground glass where the film ordinarily goes, you will be able to check and observe the 1 to 1 ratio of the object on the ground glass.

PORTRAIT AND COPYING LENSES

Q. What is the difference between a portrait and copying lens?—D. M. Maggret, Kenton, Ohio.

A. A portrait or soft focus lens is an adaptation of the single lens for pictorial workers. Fundamentally, a soft focus lens is a single meniscus, corrected for chromatic aberration and suitably mounted to work at a large aperture of f.4.5. The effect is to introduce a slight amount of aberration to produce a form of halation or secondary image, thereby causing a pleasing roundness in rendering the subject. The soft focus lens is most effective when used wide open. When closed down, the lens loses this quality and gives a clearer image. A copying lens is an anastigmat, and is highly corrected, with a flat field. It transmits every point of a scene accurately to a corresponding point on the film so that absolutely sharp copying is possible. It is fully corrected so that no softness is evident as with the soft focus lens.

X-ray Solves Secret Of Life

[*Continued from page 37*]

still an enigma to science. As yet, only a few medical men in the country are at work with this new application of the X-ray and they claim prodigious results. In the case of colds, for instance, it is claimed that when the nose, throat and sinus areas are treated by X-ray, susceptibility to cold infection is lessened, and when you catch one, it can be shaken off more readily.

Still another application of the X-ray may bring us the long sought-for secret to the fountain of youth. Heavy water, which was discovered to exist in all water in small quantities, has a bad effect on life. It may contribute to our growing old. If this is proved, some day we may remove the heavy atoms of hydrogen from our water with the aid of X-rays and live 200—300 years!

There are more results to be obtained through the use of X-rays in science's examination of life. The biologist has given an artificial method of producing mutations, changing species at will. This has already been done in the case of fruit flies, and studies with pigeons, mice, rats and cats are going on apace. It is within the realm of possibility for the X-ray technician to make changes in our cattle, to produce better beef steak or more milk or juicier lamb chops much more quickly and more certainly than by the old-style, long drawn-out breeding process.

If it becomes possible to control the sex of animals this way, the scientist can order up a brood of egg-laying hens, for instance, and save all the trouble of producing the less useful roosters. Or cows can be ordered instead of bulls or even, some day, boy babies or girl babies at will! This may be brought about scientifically by the chemical synthesis of hormones which, experimentally, is already a fact. In time the whole physical development of the human body may be chemically controlled by man with the aid of X-rays.

This possibility is already more a fact than a vision, in the laboratory. And to Herman J. Muller (working at the University of Texas at the time) goes much of the credit for the application of the X-ray to this research. Muller used various agencies, such as heat and the X-ray, to study the process of mutation, with the result that he discovered a means for speeding up the mutation rate 150 times; he had artificially speeded up the evolutionary rate! Muller had, with the aid of radiation from X-rays, broken down one of life's remotest secrets. He had shown science how man could create species of living organisms and replace natural selection by human selection. Thanks to the X-rays, the spring controlling inheritance has been discovered!

The ways in which X-rays are unraveling the secrets of life and of matter have no end. With the aid of X-rays we may yet learn more about electricity, more about electrons, more about cosmic energy, and eventually how to make the immense source of power from hemispherical bodies available to man.

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If you've been looking for a super-speed candid that takes exciting pictures by day or night, here's great news! The sensational new UniveX Mercury, at only $25, gives you the lightning speed, precision performance and breath-taking results you'd expect only from foreign-made candids costing $100 and more! 1/1000th-of-a-second shutter speed—to stop and hold breathless action at its peak! New automatic film transport to make double exposures impossible! And to cap the climax—this amazing new Mercury *cuts your negative costs in half*, because it uses economical UniveX 35 mm. film! See the UniveX Mercury at your dealer today, or send for free illustrated booklet! Universal Camera Corp., Dept. M-19, New York City.

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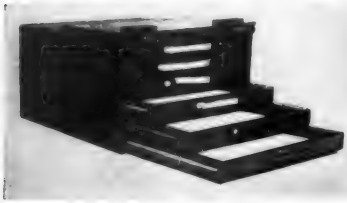
Light Proof Paper Box

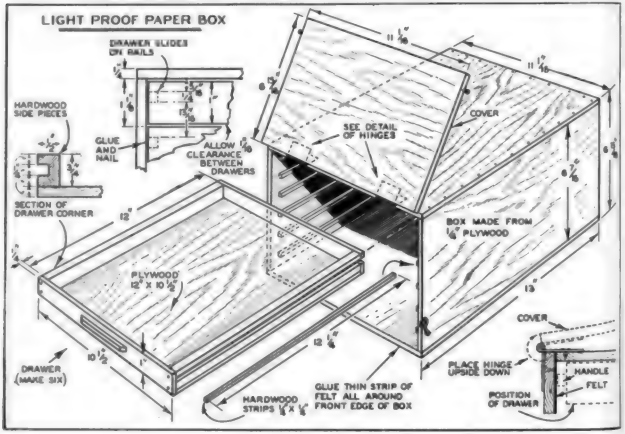


A WELL-CONSTRUCTED light proof box to hold printing and enlarging paper is practically a necessity in every darkroom, as anyone who has fumbled around with the triple wrappings of such papers, losing time and patience meanwhile, will agree. All such sufferers may now give a sigh of relief and end their miseries—by building this simple and convenient photographic paper cabinet.

It is made entirely of plywood, with the exception of the hardwood side pieces in the drawers and the hardwood strips for them to slide on. Six drawers allow you to have a wide range of papers ready for instant use. Construction is extremely easy, and, save for the grooves in the drawer side pieces, may be accomplished with an ordinary saw, hammer and screw driver. If you possess a dado head for your bench saw, or a dado plane, these grooves will present no difficulty. If not, a nearby mill or lumber yard will cut them for a few cents. Or you may secure ordinary hardwood molding that conforms closely to the size and shape of the side pieces.

Cut all pieces to the dimensions shown on the drawing. Be sure to measure accurately and cut true, as there must be one-sixteenth inch clearance between drawers, and this might be thrown off by any inaccuracies. Now fasten the hardwood drawer guides to the side pieces of the box, using glue and very short wire brads. These strips must be aligned very carefully, because each pair must be exactly

[*Continued on page* 89]



Plastics—Marvel Of Science

[*Continued from page 57*]

division of the American Cyanamid Co.). To shape the new plastic for scales the General Electric Co. built a 160,000-lb., two-story-high press, and today this concern is firmly entrenched in the molding business. In this way the industry grows, and the urea-formaldehyde materials are used for many things besides butchers' scales. Their smooth, weather-resisting surfaces become permanently hard when molded, and can be dyed in a wide variety of brilliant blues, reds, yellows and greens. In fact, these plastics in about 6,000 different shades are used to make clock cases, buttons and buckles, boxes for jewelry and perfumes, radio cabinets, and many other objects.

And the use of color is the main way plastics manufacturers hope to further catch the public's eye. Other plastics that take color are the cellulose acetates and the so-called polystyrenes, materials that can be extracted from certain kinds of benzene. Hence, the psychological effect of color is an important consideration. Plastics experts have consulted color students and learned, for instance, that the following tints were among those supposed to suggest definite moods and feelings: red suggests heat, excitement, strength; brown is the utility color; yellow gives a sensation of airiness; light blue symbolizes coolness, fragility, youthfulness; dark green gives an impression of unhealthiness and cheapness; and lavender makes you think of fragrance and refinement. From this and similar information, plastics are being dyed not only for your practical needs, but also to appeal to your emotions.

Among the newest plastics are ones that may be colored or be completely transparent. There is the methacrylate plastic made at duPont's Charleston plant from air, coal, and water. Out of these building blocks a substance is derived which, when hardened, is crystal-clear, light-transmitting, and only half as heavy as glass. It is called Lucite. The glare from window panes is due to the fact that ordinary glass reflects 8 per cent of the light that hits it. Lucite, however, only reflects about 5 per cent of the rays and hence produces a correspondingly smaller glare. Furthermore, while window glass doesn't transmit health-bringing ultra-violet light, these beams slip through the remarkable transparent plastic without any trouble at all.

But whether or not Lucite ever replaces glass in your home, it has already found many unique applications. Besides Lucite's use in making fancy candlesticks and other attractive objects, the plastic may prove a great aid to physicians and dentists. If you send light through one end of a tube-like piece of Lucite bent in the shape of an "L," the light rays will act as if they were "piped." The tube itself will glow a bit, but most of its light is held inside and comes out brilliantly at the other end. Few substances have the ability to bend light as well as this, and dentists' instru-

[*Continued on page 89*]

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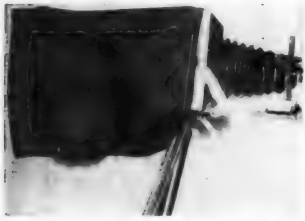
THE Agfa f6.3 Clipper Special is another astonishing value! New telescoping front eliminates bellows . . . shutter gives speeds of 1/25 to 1/100th second, bulb and time . . . hinged back, easy loading arrangement, shutter release guard, tripod socket, and built-in depth-of-field scale. Takes 15 pictures (2 1/2 x 2 1/16) on one roll of PD16 (616) film. Camera complete with neck cord . . . only $15.50. ***Made by Agfa Ansco Corporation in Binghamton, New York, U. S. A.***

AGFA CAMERAS

FOCUSING-CLOTH HOLDER

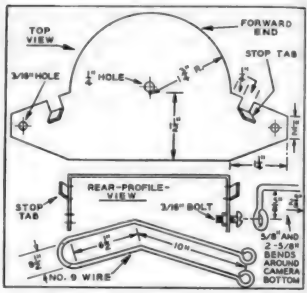
by M. W. Mutschler



When in position, one end of the focusing cloth is held against the camera with a rubber band. The length of the frame determines the amount of its extension over the camera.

Note how the wire frame is held in place on the tripod cap and how the cloth is held in place when the frame is pushed forward after focusing.

The photo below shows how simply the frame is attached and shaped.



Top: The tripod cap and focusing-cloth frame are made as indicated in the drawing. Above: Showing frame in position without the cloth. Note how it fits over camera.

THE device shown on this page is easy to make and simple to use and will prevent the focusing cloth from slipping off the camera or folding down between the eyes and the ground glass. Dimensions cannot be given for all cameras, but the measures given here are sufficient for cameras using 2¼x3¼ up to 5x7 film. It may be desirable to reduce the size of the frame for use with smaller cameras. The amount of reduction can be easily determined.

Material used for the tripod cap is $\frac{1}{16}$ inch thick. It is shaped as shown in the drawing, cut with tin snips or cold chisel and the edges filed smooth. Tabs are cut at each end of the cap to stop forward travel of the loop. The backward travel is stopped by the length of the cloth itself which is attached to the camera with a rubber band and to the loop with thread. Small bolts fasten the wire to cap and are battered on the ends to prevent them from coming out. The sketch shows the rear view and stop tabs and dimensions of the wire loop which is made from No. 9 iron wire. Coat-hanger wire is satisfactory. The eyes for the bolts can be formed with a pair of pliers around another bolt or a punch or other tool of the right size.

The cloth may be folded backward out of the way to allow a plate holder to be inserted or removed, and be ready at a touch of the hand to drop back over the head when focusing.

For extreme portability the loop may be attached directly to the camera with small screws, with the upper part and sides of the loop formed square just enough to clear the camera.

Plastics—Marvel Of Science

[*Continued from page 87*]

ments have already been made with light bulbs in their handles to which are attached Lucite tubes shaped so they can throw light into any corner of the mouth or throat. Also, doctors have had to remove wood or metal splints from broken limbs to see how far healing has progressed. With recently designed Lucite splints, however, it will be possible to keep a patient's bones in a firm position and at the same time examine the fractured arm or leg without removing the support.

Rohm & Haas Co., Inc., in Philadelphia, make two transparent plastics of similar composition called Crystalite and Plexiglas, and among the possibilities of such materials are plastic lenses. When you go to an eye specialist for a pair of glasses, you may have to pay from $5 to more than $20. A large part of this expense goes to expert lens makers who have to grind glass carefully to remedy your particular ailment. But prices may go tumbling down if plastics experts can make long-lasting lenses by high-speed molding methods.

One plastic is made with casein, a chemical found in milk. Another new German material may be used for printing type, since it has many of lead's best qualities and is much lighter. But Dr. Baekeland's company is more than keeping up with latest developments. It makes more than 15,000 different articles for 35 major industries, and recently a spokesman announced that the Bakelite Corporation, in cooperation with the United States Army and Navy, was preparing to make airplanes with the aid of plastics. This is to be done by "soaking" wood with plastics, and the process is expected to eliminate all riveting and make it possible to construct 20 to 30 planes in the time it takes to build one.

Meanwhile Dr. Baekeland, at 75, rarely misses a day's work. He is firmly established as one of the greatest pioneers in the plastics industry.

Light Proof Paper Box

[*Continued from page 86*]

on the same level when the box is put together. Assemble the two sides, top and bottom with glue as before, and longer brads. While the glue is setting, the six drawers can be nailed and glued up. A hinged cover and a strip of felt running all around the front edge of the box complete the carpentry work. Attach a small hook to hold down the cover as shown, then give all parts a light sanding and a coat of varnish stain. Drawer pulls can be made from scraps or purchased at the five and ten.

When the box is not in use the front cover is dropped down and hooked, rendering it perfectly light tight. A light coating of soap along grooves and strips will insure the drawers sliding easily. —*R. M. Searles.*

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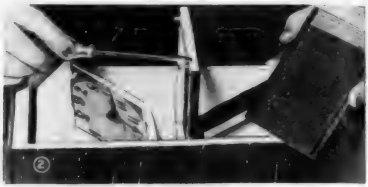
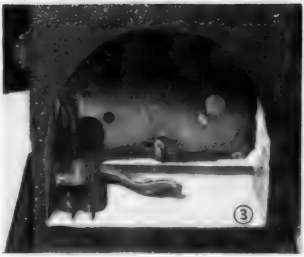




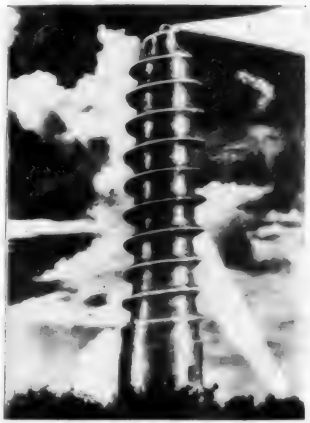
THIS combination unit is 18 inches high and just wide enough to take a Wratten safelight in a book-type opening door. (See Fig. 1.) Beneath this is mounted a standard square case, 60-cycle electric clock available in drug stores. It is mounted in a frame to tilt up or down. Thus the safelight illuminates the clock dial as well as supplies light in the darkroom. A 10-watt lamp is ample, and will enable you to see the clock dial clearly.

The manner in which the safelight glass is held in the illuminating box is shown in Fig. 2. Two machine screws are run right through the "door" and terminate in two $\frac{7}{16}$ machine screw anchors in the body of the housing.

Figure 3 is a rear view of the instrument, showing the plug-in manner of connection to the 110-volt house current. The base should be a fairly heavy piece of wood, but the remainder of the unit may be thin wood or metal. —*Herbert E. Hayden.*

Futuristic Tower Of Light

TO MAKE this trick shot, an enlarged photo was made of a common 1½-in. wood screw. The image of the screw was cut from the print and pasted to another made from a cloud negative. The base line of trees was painted on the combined print with water color and the combination was copied with the camera on process film. The beams of light were worked in by hand on the copy negative and the final print was then made.



100 M.P.H. With An Outboard!

[*Continued from page 49*]

over the water at 5 miles an hour. That's still better than rowing and when you consider that this motor delivers full speed, hour after hour, you never want to look a pair of oars again in the face. If you like a little more speed, there's always a 12-mile-an-hour motor available under a hundred dollars.

We have to thank, too, the intrepid outboard race drivers who rode and are riding the roaring midget demons over the water ways. Driving an outboard in a race is as thrilling, if not more so, as automobile racing. The racing engines exhaust above water amid a deafening roar; they throw spray like a fire hose and the boats themselves bounce with such terrific force that sometimes their bottoms are ripped out and this despite their hardwood hulls fastened with specially hardened vanadium steel bolts. Gar Wood offers his own version of what can happen, did happen, when all is not right with the racers. Gar Wood claims that Sir Henry Seagrave was killed while trying to smash the world's speed record of 124 miles an hour because the bottom of his boat was wrenched out due to his terrific speed in the water. Sir Seagrave was experimenting with a new "step" (the point where the higher forward planing surface breaks and the aft planing surface begins). Such accidents will happen and it is to these men that much is owed for the development of lighter and faster engines and boats.

To many, outboard racing may seem a luxury sport, but it is amazing how an apparently worthless race can contribute to the improvement of an engine. An apt example of this fact is Gar Wood's experience in the development of certain types of marine engines. It was his opinion that engines had to be light as well as fast. He introduced the use of aviation engines as "marine" engines in 1923, but his racing entry was disqualified by racing officials who claimed his was not a "marine" engine. Upon appeal to the American power-boat association, the definition of a marine engine was given as "any engine manufactured or assembled and offered for sale as a marine engine, is a marine engine." Thereupon, Gar Wood rebuilt an old Liberty engine and put it in a baby Gar runabout. He advertised the engine for sale as a marine engine, thus fulfilling the qualifications of the definition. He had no buyers—probably because he asked $25,000 for it—and so, entered the race. The race was held in Buffalo, in the summer of 1923. The race committee got something of a shock when Gar Wood and his mechanic, Orlin Johnson, appeared dressed in formal attire—top hats, white gloves, spats and all.

"What's the idea?" the committee wanted to know.

"Well, the rules describe this as a 'Gentlemen's Runabout Race' and we're taking no chances of

[*Continued on page 97*]

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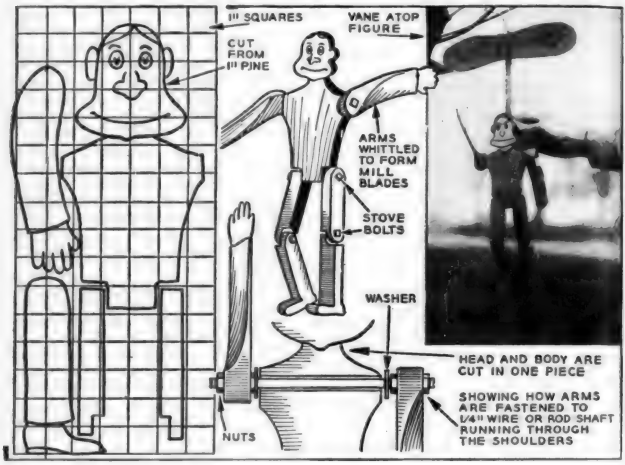
WINDY WILLIE

THE HANGING WINDMILL



ALTHOUGH animated toy windmills are increasing in popularity every year, there never seems to be a great enough variety of the designs, particularly of the comic variety, to satisfy the windmill "fans." Here is Windy Willie, a novel comic one, which, while having no intricate moving parts to complicate construction, is still so original that it attracts more attention than many of the more complex type.

As will be seen from examination of the photograph and detailed construction drawings above, the little mill is designed to hang from a tree limb or other support, and to swing freely in the wind. The figure is made of one-inch pine with the head and body in one piece. The arms are whittled to form the mill blades, and fastened to a shaft running through the shoulders. The legs are in sections, joined together with stove bolts, and when the mill is turning, the jarring of the entire figure causes these to jig in a comical manner.

Cut the figure from the wood with a coping, jig or scroll saw, first transferring the accompanying squared design, full sized, to the wood and using it as a guide. Whittle the arms in regular windmill fashion, and use a length of quarter-inch iron wire or rod threaded to receive the nuts, for the shaft. The vane arrangement, attached to the back of the head by a wooden stick (see photo), keeps the figure turned more or less to the wind so the arms will swing. As the figure swings it will necessarily be quite active, and the arms will revolve intermittently.

After Windy Willie has been assembled and tested, decorate him in gay enamels and paint in his face, hands, etc. For a more permanent job, his features may be traced onto the wood before painting, then carved out with a sharp knife. Several Windy Willies, with various comic faces, will make attractive and novel decorations for your trees or terrace.—*Paul Hadley.*

Rock Gardens, Pools

[*Continued from page 72*]

Fig. 3 shows a diminutive lighthouse of similar construction, sitting on a base of concrete. The top, which is removable, is fitted with a five-watt bulb, in a socket which is connected to the electric supply so the lighthouse can be made to light in realistic manner. Construction of the base is easily done, by making a small wooden frame in square shape, filling with concrete, then setting the galvanized iron "tower" in place before it hardens. Of course, you must make your electrical connections before this is done, leading the wires preferably down through the base inside a metal pipe or conduit.

The little water mill, shown in Fig. 4, is decidedly decorative, and with the exception of the wheel, which actually turns when the water runs over it, is entirely of small stones set together with mortar, and a roof of imitation shingles. Little description of this ornament is necessary, as the picture speaks for itself. The wheel can be made of sheet metal by your tinsmith, or by yourself, and should be well balanced. It is fitted with cross "paddles" about two inches apart on a wheel of say, 10-in. diameter. The wheel should be mounted on a shaft, which in turn is set into the wall of the mill. The "millrace," (the trough which leads the water to the top of the wheel from the water supply), is of metal or wood, and the stream is led to this from the water supply in a concrete trough. A second trough at the bottom of the wheel, leads the water into the pool, after it has dripped from the wheel.

Many other variations of these gardens and their ornaments can be devised. For instance, a small stone bridge can be made by laying stones in concrete mortar over a carved wooden support. After the concrete has set, the support can be knocked out from underneath, leaving the bridge clear. For added strength, a couple of strips of heavy strap iron, ½-in. thick, can be laid over the support before the concrete is applied, making a bridge which will bear considerable weight. A concrete birdhouse, upon a laid up rock pillar is another attractive idea. The four small pillars, supporting the house itself, are made by filling quart fruit jars with concrete, then breaking the glass away after the concrete has hardened.

Lily pools must contain lilies, and these are best set out in buckets of mud, and then submerged in the pool. There are many other water loving plants, and suitable shrubs for rock gardens can be easily procured from any nursery or plant dealer.

Luminous stucco that glitters in the sun is being used on some buildings for the Golden Gate International Exposition in San Francisco.

The United States is the world's largest consumer of crude drugs used in preparing medicines.

Don't wait for your radiator to boil before you clean out the rust and scale that clog it! Use 10c worth of Sani-Flush at least twice a year (25c for the largest trucks and tractors).

Here's all you have to do: Pour in Sani-Flush. Run the engine. Drain. Flush. Refill with clean water. (*Directions on the can.*) Sludge and sediment are flushed away. The motor runs cool. You save power and fuel. You may save unnecessary repair bills. Do the job yourself. Or ask your garage or service station to flush your radiator for you. Insist on Sani-Flush. It cannot injure motor or fittings. You'll find Sani-Flush in most bathrooms for cleaning toilets. Sold by grocery, drug, hardware, and five-and-ten-cent stores. 25c and 10c sizes. The Hygienic Products Company, Canton, Ohio.

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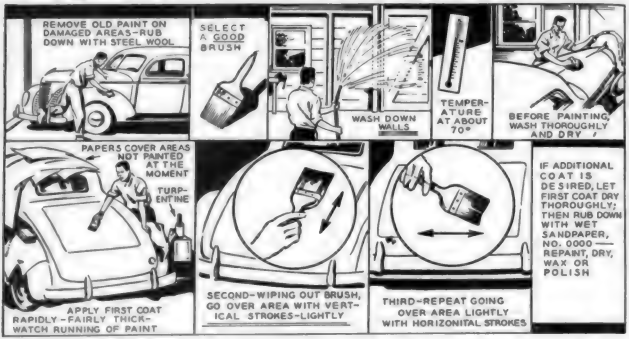

THERE'S nothing that adds quite so much to the appearance and resale value of a car as a shiny new coat of paint, free from streaks and dust specks. A refinishing job at a regular paint shop is quite expensive, but by following a few simple rules and precautions, you can do the work yourself at a fraction of the cost. The results will be durable and attractive.

Painting an automobile involves more than just opening a can of enamel or lacquer and slapping it on with any old brush that happens to be handy. In the first place, everything must be *clean* and perfectly free from dust. That includes the surface to be painted, the brush, and the room or building where the job is to be done. Don't try to use a cheap brush. You can apply the paint much smoother with a good quality brush, and it won't be shedding its bristles all the time. A good grade of enamel or lacquer is also essential, and is much cheaper in the long run, besides making a better-looking job.

The most important precaution, and perhaps the most difficult to observe, is the elimination of dust. If possible, do the painting in a small garage or building, free from drafts, preferably some distance from the street so that the vibration of passing vehicles won't shake down any dust. The day before the painting is to be done, the building should be thoroughly swept out, particular attention being given to corners and other places where dust has collected.

Now wash the car thoroughly with linseed oil soap, removing every trace of mud, grease and dirt. One of the secrets of a good paint job is to have a clean surface. Even fingerprints will keep the finish from adhering properly, causing unsightly spots when it dries.

Before starting to work, cover any cracks in the floor and walls, or around the doors and windows, with sheets of dampened cloth, and wet the ceiling, walls and floor with a garden hose. Put a little clear varnish on a piece of cheesecloth and go over the car with it to pick up any dust that might have settled after the washing process. Let the varnish dry until it becomes slightly tacky before using the cloth.

The paint should be stirred well with a clean stick, and if it contains any lumps, should be strained through cheesecloth before using. Temperature of the room should be about 70 degrees F. for best results in application and drying. In cold weather, a small portable oil heater may be used. To prevent stirring up any unnecessary dust, don't let anyone enter the room while you are painting or before it dries.

Most professional painters begin at the top and work downward, doing one panel at a time. Running boards may be protected with sheets of wrapping paper or newspaper. Keep a turpentine-soaked rag handy to wipe off any paint that might get on the door handles, windows, or other unpainted surfaces.

[*Continued on page* 113]

MI Fly Electrocutor

[*Continued from page 67*]

wires in place with a light hammer. Drill holes in the larger disc for bolting an ordinary porcelain lamp socket and another for the connecting wires. Two holes will have to be drilled very accurately to slip over the ends of the bolts extending from the power unit. This method of attachment makes the grids interchangeable.

Connect each group of grid wires by soldering a copper wire to the ends of each. Both wires and the two Presdwood discs should then be well coated with asphalt varnish, which is an excellent insulator for high-voltage current.

To make the "regular" grid cut two Presdwood discs as before, but instead of drilling holes, cut six slots in the edges to take as many ⅝ by 6-in. strips of the 3/16-in. Presdwood. Glue these in place. Make shallow saw cuts in the edges, so spaced that two parallel wires, about 3/16-in. apart, can be wound over the entire outside. A 10c spool of ordinary tinned annealed wire, No. 30 or heavier, is suitable. If you wish the safety feature of a staggered grid, make alternating saw cuts deeper than the others and closer together. Solder two insulated connecting wires, for transformer leads, then coat the Presdwood with asphalt varnish.

Both the de luxe and "regular" grids are used with an interchangeable catch pan at the bottom, which also serves to complete or balance the design. This consists of another 5c pie tin fitted with a spring clip which is inserted in the 3-in. opening of the lower Presdwood disc. A knob on the bottom will make it easy to remove the pan for emptying. All metal parts, excepting the grids, should be coated with black crackle-finish, air-drying lacquer. A small can of this may be purchased of one of the radio supply houses, previously mentioned, for 25c, and it gives a manufactured appearance to your work.

Throwing Targets

[*Continued from page 73*]

that will catch in the cloth at the peak of the parachute cone. Make the parachute "life lines" of thread, using five or six of them, each about 9-in. long and attached to the edge of the parachute, spaced equally. The lower ends of the threads are tied to a heavy metal ring or washer which will slip freely over the arrow. Make a sturdy bow from a willow or strip of ash or cedar, one which will shoot the parachute arrow high into the air. At the top of the ascent the arrow will drop free of the "chute" and the metal ring will drop, filling the "chute" with air. It makes a fine target to throw at as it descends. Shoot the arrow directly over your head so that the "chute" will not drift away too far as it floats to the ground.

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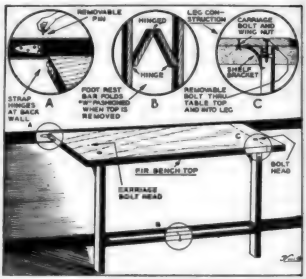
WORKBENCH for Cliff Dwellers

THIS workbench for cliff dwellers can be assembled in a few minutes and can be stored easily behind an ice box or in a closet. The original was built for use in the kitchen of a small apartment, and has served as wood carving bench and blacksmith shop as well as general utility bench. Dimensions will depend upon individual needs and space.

Fir should be used for the bench because it does not warp readily. The back of the bench is fastened to the wall with strap hinges; heads of hinge pins are filed off so pins may be drawn easily when taking bench down, as in diagram A. Three hinges are used so that foot-rest may be folded "W" fashion, as shown in diagram B. Leg construction is shown in diagram C. Notice use of shelf bracket for backward and forward support. A carriage bolt and wing nut fastens back of bracket to bench. Front of bracket is fastened only to leg. The bolt through the bench top is a half-inch standard square head. Nut is slid into slot in leg in manner often used on antique beds. To facilitate handling of nut, a loop of wire or small rod may be soldered to it for a handle.

Here are a few hints for using. Don't hammer after 8:30 p. m. or early Saturday or Sunday mornings. Sound can be deadened by laying objects to be hammered on a rubber pad.—*G. Ralph Kiel.*



Construction details of this workbench for small apartments are shown above. Fir is recommended, although any fairly solid wood will do. Dimensions depend on space available.

A few of the objects which have been made on this useful workbench, including pistol grips, knife and clock base.

100 M.P.H. With An Outboard!

[*Continued from page 91*]

being disqualified. We're gentlemen!" Gar Wood replied.

Gar Wood walked away from the field and the auto and aviation marine conversions have since come to be accepted by the industry. Equally interesting stories could be told of racing sailors whose experience resulted in improvements in the industry as well as in the engines.

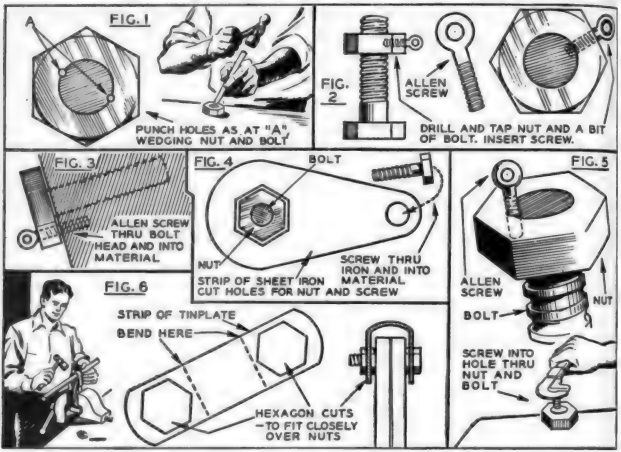
The pioneer work of these men eventually made it possible for Bedford Davie to set his now-famous record. Davie had come a long way since the Mississippi Valley Power Boat Association race in 1924. In 1925 the 8-mile speed was doubled to 16 and three years later, in 1929, an outboard was clocked at the terrific speed of 45 miles an hour. There was a slight lull after 1929, as in everything else, but in 1935 the speed demons again took to the waterways and have been rapidly pushing it up year after year. At the rate the outboard addicts are going, they will shortly be topping the 100 mile-an-hour speeds now being talked about so glibly.

Of all the races that are contributing to the further development of the outboard, perhaps the most gruelling in the country is the Albany-to-New York 150-mile race held every May. This is an all outboard affair over a rough course with tricky currents. Choppy waters, hidden sandbars and floating objects present a continuous nightmare to the harried driver every mile of the 150. Fouled plugs, broken fuel lines, burnt pistons and cracked cylinder walls, to say nothing about fires, broken propellers and shafts and exhausted motors, are just a few of the things participants in this terrific race have to contend with. At the start of the race 10 to 20 per cent of the entries are fouled before they even cross the starting line and fewer than 40 per cent ever finish.

The 1938 race was won by Ted Roberts. He had been trying for the past 8 years before luck smiled upon him. When Roberts finished, he was so exhausted and helpless that he had to be carried from his outboard racer. His speed wasn't spectacular as speeds go (he averaged 33 plus) but try that course yourself sometime before you begin to sneer. Roberts claimed he needed those 8 years of experience to ready himself for this winning run. During those years he experienced all sorts of engine failures and with each race he learned to correct some other weakness. Finally he achieved an engine strengthened against failures as much as was humanly possible. What Roberts learned by experience and what other men like him learned has been handed down to the manufacturers and eventually passed on to the little fellow—the man who glides blithely along in a 6 or 10-mile-an-hour put-put, or even an 18 or 40-mile-an-hour outboard, king of all he surveys.

And don't forget. That hundred-mile-per-hour speed will be here soon!

Different Ways To Lock a Nut



NUTS which persist in loosening from vibration on tractors, automobiles, motorcycles or other machines not only cause accidents, but inconvenience and much loss of time as well. However, at least one of the above methods of locking can be made to securely hold any size or style of nut in the position desired, using ordinary tools.

In Fig. 1 the end of the bolt is cut off flush with the top of the nut, and the two "dots" marked (A) are made with a hammer and pin punch to prevent the nut slackening off. This method can be applied to nuts that do not require frequent removal. One of the most satisfactory ways to lock a nut, especially large, coarse threaded ones that loosen easily under vibration, is by means of an Allen screw.

Fig. 2 shows bolt, nut and Allen screw which goes down through a crosswise hole drilled and threaded in the nut. For all ordinary purposes a well-tightened Allen screw will prevent the nut from coming loose, but making a countersink in the threads of the bolt with a small drill before the Allen screw is inserted will give the latter a grip on the bolt that will defy loosening. In Fig. 3 the Allen screw goes through threaded hole in head of the bolt, and seats in countersink drilled in body through which the bolt passes.

Fig. 4: Lock for nut using light sheet iron strip with hole cut in one end to fit snugly over nut while other end bolts to any convenient section of surrounding material. Fig. 5 demonstrates another use of the Allen screw. In this case, the hole for the screw is drilled half in nut and half in bolt.

Bolts and nuts that hold two pieces of material together and are in the habit of continually working loose can often be anchored as shown in Fig. 6. A strip of tin-plate with suitable hexagon cuts in each end is slipped over bolt head on one side and nut on the other. Dotted lines show where plate should be bent. Be sure to make the lock long enough so that it will reach from bolt head to nut. If slightly too long a wedge can be driven through loop at the top.—*Ivan J. Stretten.*

Summer brings the fragrant odor of steaks and coffee cooking over an open fire, and the keenness of appetite that accompanies a meal out of doors. July MECHANIX ILLUSTRATED will contain plans and instructions for building such attractive barbecue pits as to satisfy the most particular open air epicurean.

Scientist Explains How Sun Will Cause End Of World

The end of the world will come when the amount of hydrogen in the sun becomes only a few per cent less than it is now, declared Dr. George Gamow, professor of theoretical physics in a lecture at George Washington University a short time ago.

But don't worry too much. The world's end will not come during the lifetime of you or your descendents to the generations of the nth degree. It will even be difficult to observe any climatic changes for a long time due to the gradual increase in the sun's heat.

Yet, despite this present comforting picture, scientists can see that the sun is bound eventually to become about 100 times brighter than it is now, when the hydrogen content falls only slightly.

"Such a brightening of the sun," declared Prof. Gamow, "will necessarily lead to the melting of the earth and, of course, the disappearance of life."

In his lecture on "The Evolution of Stars," Prof. Gamow showed that transmutation of the elements—and particularly the transformation of hydrogen into helium—accounts for the enormous amount of radiant energy liberated by the stars and our sun. Temperatures of several millions of degrees are attained inside stars.

The rate of the reactions of atomic nuclei, leading to the energy production, depends essentially on the mass of the star, Prof. Gamow said. Very heavy stars, with masses several hundred times as great as the sun must be very bright and hot. They are known as "blue giants" to astronomers. Stars of very small mass are faint and reddish in color and are called "red dwarfs."

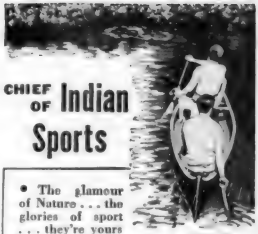
The eventual destiny of our sun, after it has long since melted the earth, is gradually to become an absolutely dark and cold body of very high density. This will occur after the sun passes through a period of maximum brilliance which it is now, very slowly, approaching.

A Finnish product is a substitute for wooden plugs for knot hole fillers.

A soap substitute exhibited at Leipzig Fair is a perfumed jelly in a tube, used without water or a towel, according to manufacturer's claim.

The land around London, England, was 60 to 70 feet higher in the late Stone Age than it is now, and it is sinking at a rate of nine inches a century.

Home economics experts say that dark colored lamp shades can waste as much as 40 per cent. of the light from a lamp.



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DELAYING THE BROADCAST

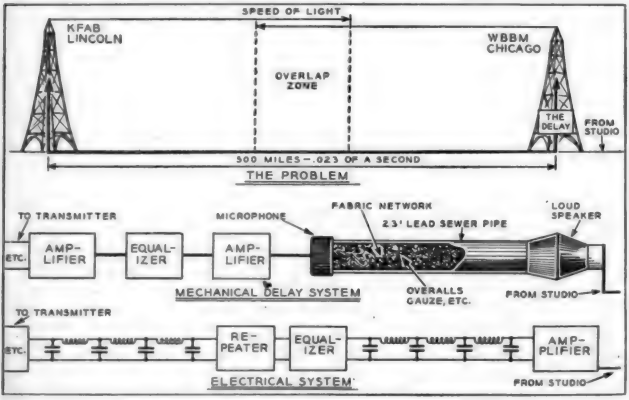
A FEW weeks ago the popular radio show, *Information Please,* used the following catch question:

"Who hears the speaker first, the people at the back of the auditorium, or the people 3,000 miles across the country who are listening to the broadcast of the speech?"

The catch was that radio waves travel with the speed of light, 186,000 miles per second, and sound waves only 1,080 feet per second. Therefore, the answer went, the listeners three thousand miles away would hear it first.

However, in the actual broadcast of a speech from, say, New York to San Francisco, the tripper-uppers would find themselves tripped. The program would go over a network, which would mean that it would travel through three thousand miles of telephone wire or cable before reaching the west coast, and the impedance of the telephone wire would delay it about one-fifth of a second, so that listeners in the

Frank Falknor, chief engineer of CBS central division, and F. R. Heuberger, master control engineer, test the electrical system that delays WBBM broadcast exactly .036 second.



Delaying The Broadcast

[Continued from opposite page]

auditorium would be the first to hear the speaker.

This characteristic property of wire and cable caused many a headache for the Columbia Broadcasting System when station WBBM in Chicago and KFAB in Lincoln, Nebraska, were synchronized on 770 kc. There was a strip fifty or sixty miles wide about midway between the stations where their signals overlapped, so that a set tuned to 770 kc. would pick up both stations.

It was a simple matter for the engineers to match the frequencies exactly so that listeners would not be bothered with squeals or howls. But the line running from Chicago to Lincoln delayed the Lincoln broadcast by twenty-three thousandths of a second, while radio waves themselves traveled with the speed of light. As a result, the program from KFAB would reach the listener twenty-three thousandths of a second later than the same program from WBBM, enough to cause a hollow tone about the same as you would get if you yelled into a barrel eleven feet deep.

Frank B. Falknor, chief engineer of Columbia's central division, undertook to solve the problem. It boiled down to a question of delaying WBBM's broadcast exactly twenty-three thousandths of a second, and doing it without spoiling the tone quality. There was no equipment anywhere to do the job, and development of an electrical delay system was a matter of months. As a stop gap he rigged up an ingenious mechanical contraption, warranted to make Rube Goldberg green with envy.

He started with a section of lead sewer pipe, twenty-three feet long. It would take a sound wave twenty-three thousandths of a second to pass through it. At one end he put a dynamic loud speaker, fitting it to the pipe with a matching unit that would permit the sound waves to feed into the pipe without echoing. This speaker was connected to the studio microphone, or to the incoming wire from an eastern network program.

At the other end of the pipe he mounted a dynamic microphone. So far, so good. He had produced the necessary delay. But when sound waves hit the mike some of them bounced right back. When they met the waves coming from the speaker they produced a series of beats or humps that ruined the program, making it worse than the barrel tone they were trying to kill.

To choke these echoes he installed a network of cloth in the pipe, starting with gauze near the center and using heavier and heavier fabrics as he approached the mike end. The final pieces were chunks cut from mechanics' overalls!

This equipment worked fairly well, but there were still a few humps that the fabric network was unable to kill, and the total volume was reduced. Accordingly, volume was stepped up with an amplifier, and the humps eliminated by a series of equalizers, one for each hump, with an amplifier between each of them.

[Continued on page 102]

Simplify Bullfrog Culture

[*Continued from page 51*]

succeeded in improving the mechanical operation of the tanks and raised nearly all of 7,000 frogs placed in seven tanks immediately after transformation from the tadpole stage. Not only had he reduced mortality almost to the vanishing point, but produced bullfrogs 20 to 22 inches in length overall, marketable frogs weighing three to three and one-half pounds each, in the record time of seven months! With such frogs worth half a dollar each in Los Angeles markets that call for thousands while he could deliver only by hundreds, Stearns moved to Los Angeles County and is now engaged in setting up the Parker and Stearns Frog Farm near El Monte. As these lines are written only five tanks have been completed toward the ultimate goal of 100, with a production of 100,000 marketable frogs every seven months. In addition to that income Stearns is apparently destined to receive some handsome patent royalties accruing from the use of his tanks and methods by frog farms in all parts of the nation.

Under the Stearns system of bullfrog culture propagation follows most of the common practices of the last thirty or forty years up to the point of tadpole transformation. There are the usual spawning pools for breeders, tadpole ponds and food culture ponds for raising the living food required by frogs of all ages. Beyond the tadpole stage, however, the tank system comes into play as a radical departure from methods previously used by frog farmers.

Baby frogs are carefully matched for size and placed 1,000 each in the series of tanks. Except for a concrete lip, 24-inches wide encircling the bottom inside the tank, 16-feet in diameter, the entire base of the tank is open. The frogs, it is claimed, derive certain benefits from this contact with the earth.

This arrangement also creates a round, earth-lined pool, 18-inches deep and 12-feet in diameter at the bottom of the tank.

By maintaining the water level at this depth in the center pool two inches of water is kept over the concrete lip. Since the frogs spend most of their time on the lip this depth of water creates the condition that frogs seem to like—the ability to sit with their bodies partially submerged.

The center pool is equipped with a four-inch drain pipe controlled by a valve outside the tank. Prior to feeding, an operation that is done only twice each week, approximately 100 pounds of live frog food (carp minnows, goldfish, large earthworms and crayfish seined from the food culture pools—or taken from the earthworm culture beds in the case of earthworms) are liberated into the tank. It is the natural instinct of these creatures to move toward the wall of the tank. The drain valve is then opened and the water lowered to a depth of about two inches in the center pool. A series of small perforations in the flange of the concrete lip causes the water to drain from the lip completely. This leaves the living frog food "drydocked" on the lip—earthworms and crayfish crawling about and minnows flapping, completely at the mercy of the frogs. When this happens the scene inside the tank is one of tremendous activity —frogs jumping in all directions gorging themselves upon their helpless living prey. In a few minutes the 1,000 frogs obliterate every trace of the living food. The normal water level is then restored.

The feeding operation also serves to make a thorough cleansing of the tank—frog excrement and other contaminations of the water being removed through the drain pipe when the water is lowered. Restoration of the normal water level replenishes the tank with pure water softened by having been put through a water-softening system. It is to this cleansing feature of the tank system of culture that Stearns attributes the complete freedom from disease of his tank-raised frogs—no red leg, the disease that has ruined many a frog farmer—mortality from any cause reduced to negligibility.

Frog tanks such as those depicted in the accompanying photos can be built for about $50 each, including the shed roof and all necessary fittings. That cost seems very nominal when weighed against the inventor's accomplished demonstrations of a production of approximately $500 worth of frogs from each tank every seven months. The tank system of frog culture is essentially a mechanical method of accomplishing what successful frog farmers in Japan have long been doing with costly and elaborate equipment and endless hand labor.

Delaying The Broadcast

[*Continued from previous page*]

The contraption worked like a charm. Programs started going through it at the same instant they started over the wire to Lincoln. By the time it had bounced down the pipe, passed through the equalizers, and reached the transmitter, the corresponding impulse was leaving the antenna in Lincoln. Its fidelity was fairly good, with accurate results over a tone range from 100 to 5,000 cycles.

The electrical system now in operation has even greater fidelity, covering the range from 50 to 6,000 cycles. It is made up of electrical filter sections, equalizers, and amplifiers. Each filter section delays the impulse by an infinitesimal fraction of a second, but in so doing reduces the volume of some tones far more than others. Hence, it must next go to an equalizer, which levels the volume for all tones, but actually cuts total volume. Next it is fed through an amplifier, then to another filter section, etc. In actual practice twenty sections are needed, the delay required now being thirty-six thousandths of a second because of a new cable installed between the two cities.

Winner Of "Men With Wings" Contest Meets Famous Star

The thrill of meeting famous motion picture stars after flying from his home in Des Moines, Iowa, to Hollywood, Calif., in a huge airliner has been experienced by MI reader Howard C. Johnson, shown talking to Jackie Cooper, popular screen actor. Johnson was given the free air line trip for placing first in the "Men With Wings" contest conducted a short time ago by MECHANIX ILLUSTRATED in co-operation with Paramount Pictures, producers of the all-Technicolor motion picture after which the contest was named.

Device Measures Air Pilot's Ability To See In Dark

Development of a device to measure the sensitivity and adaptability of an airplane pilot's sight under conditions of low illumination was announced by a man-and-wife research team, Drs. C. E. Ferree and G. Rand of the Research Laboratory of Physiological Optics in a recent issue of the technical journal, Science.

Known as the Ferree-Rand Light Sense Tester, it measures a person's ability to look from fields of vision such as the instrument board in the cockpit to points outside the window. Through its usefulness in checking the eyesight of pilots, it should add to safety in the air.

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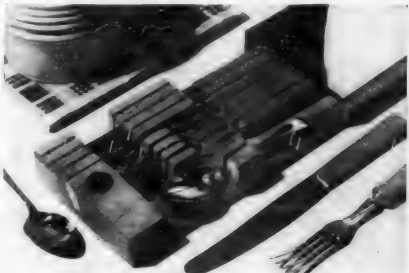

For the tidy housewife, this compact knife, fork and spoon cabinet will have much appeal. The inner section is made of wood and features grooved sections in which the various silverware items are inserted, as shown in photo. A metal slide-over cover completes the cabinet.

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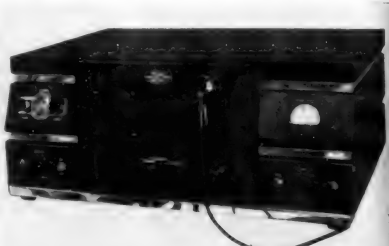

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The DC-5, Douglas' 16-passenger entry into the feeder line airplane field, also has it, the first high-winged transport to come from an American factory in several years. Its use can be attributed directly to the passengers' and the operators' demand for better visibility. Passengers would like to enjoy the scenery for a change. In present low-wing types, the panorama of the earth below is only partially visible from the extreme forward or extreme rear tiers of seats. Everyone else must enjoy an expanse of duralumin wing, which is often actually uncomfortable—if it catches the sun's reflection.

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Reproduces Mission Bells

That mission bells again may be heard throughout the country, Mrs. A. S. C. Forbes of Los Angeles has devoted her life to making reproductions of the bells brought around Cape Horn in the days when California was being settled.

Each an exact copy of one of the original bells used by the early California padres to call their flocks, Mrs. Forbes' products weigh as much as 250 pounds and as little as five ounces.

During the last few years Mrs. Forbes' bells have gone into practically every state in the Union and to several foreign countries. People in Australia, Alaska, India, Hawaii, Italy, England, and in South American republics, are today being called to church by bells which she has designed and tuned.

The bells most copied are those of the mission at San Gabriel, the one at San Luis Rey, the one at Santa Barbara and the one at San Fernando.

For her largest church bells Mrs. Forbes has received as much as $600; for her average size ranch home bell she receives from $10 to $25.

"A bell must be proportioned exactly right and must be tune-tested before it leaves my hands," says Mrs. Forbes. "That is why the sounds of the old missions are being heard again all over the country and that is why I have all I can do to keep up with demands for bells."

In a study of how adults use their time, one investigator has found that 39 per cent of adults have one or more hobbies.

An oil well in California is producing from 15,019 feet below the surface—almost three miles deep.

Pictures By Radio

[*Continued from page 60*]

the paper, scanning a line at a time and transmitting the contrasting tones of the image as a continuous series of electric waves of varying intensity. Any black and white matter, such as photographs, drawings, written, typed or printed words, diagrams, etc., can be fed into the machine in the form of a continuous roll.

At the receiving end, the process is reversed. A sensitive stylus at the end of a swinging arm sweeps across a specially prepared white paper, in exact step with the moving electric eye at the broadcasting station. The electrical impulses, passing from the stylus through the paper, oxidize the surface of the latter, and cause it to turn black wherever the image was black on the picture being transmitted. The paper advances upward out of the machine automatically, moving up a notch each time the stylus completes a line. In the morning the owner of the set simply tears off the printed part of the roll and reads it at his leisure.

Facsimile is widely confused with television, although the two processes bear no relation to each other. Facsimile is primarily an electrical recording system, in which time is relatively unimportant. Television is popularly defined as *instantaneous* sight at a distance by electrical means; the looker-in at the receiving end sees fleeting images of an event *while* it is happening.

A Pool Lamp For Living Room

[*Continued from page 75*]

Turn the spindle to the shape shown, or to your own specifications, and drill through for the cord after finishing. Replace the base and turn (bore) a hole 1-in. in diameter and 1½-in. deep through the center after carefully drilling through the lead. Continue the hole ½-in. in diameter through to the bottom. With the drill press, bore a ⅜-in. hole from the edge to the center for the cord outlet. Lacking the drill press for this precision boring, you can cut a groove of the required width and depth to take the cord, later driving small staples over it.

Mount a brass ferrule for the socket on top, wire and lead the cord through the holes before gluing the spindle in place. Glue felt on the bottom. Any appropriate shade will do.

The pool can be "stocked" in several different ways. A small cup of gravel is ideal to add since you may thus hold bulbs or rooted plants firmly upright. Bits of the sheet lead scrap may also be carefully wrapped about the roots of a plant to hold it upright and in place. A small, sturdy ivy plant or two will also grow well here. The fish (if any) should be chosen for their small size first and their beauty second. A snail or two may also be added. Bits of moss, a small lily pad can be used.

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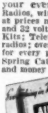

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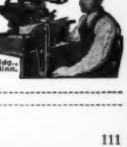

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Produces Fire From Water And Sunlight

Moses, you will recall, amazed his followers by striking a rock and having water gush forth. More amazed would his followers have been if Moses had then snatched some light from a sunbeam and made it turn the water into a flame that would burn as long as there was water to feed it.

Substitute Mohr for Moses in this sequel to the Biblical tale and you can bring the story up to date for at Concord, California, Otto H. Mohr is really using sunlight and water to produce a flame.

No miracle or stunt is inventor Mohr's device. He passes electricity through water, decomposes it into hydrogen and oxygen gas and then burns the hydrogen. His electricity Mr. Mohr obtains by focussing sunlight on thermocouple junctions.

The "hot" junctions of the thermo elements are enclosed in a vacuum while the "cold" junctions have little vanes attached to them so that they can radiate heat to the air. Thus, no matter what the temperature is, there is always the necessary heat difference between the two junctions to produce electricity by the thermoelectric effect.

Out of each gallon of water decomposed Mr. Mohr can obtain 175 cubic feet of hydrogen gas, according to the technical journal, *Refrigerating Engineering*. He now has in operation a small sun ray plant that can be carted in a wheelbarrow, which can decompose 1.5 gallons of water a day. A plant twice this size, Mr. Mohr estimates, would supply the needs of a family using gas for cooking, water heating and refrigeration. A water-sealed storage tank would supply hydrogen on sunless days.

Amateur Astronomer Finds First 1939 Comet

Lick Observatory at Mt. Hamilton, Calif., and Yerkes Observatory at Green Bay, Wis., have confirmed the discovery of the first comet of 1939, found on January 19, by Leslie C. Peltier, amateur astronomer of Delphos, Ohio. Positions of the planet have been confirmed by Prof. George Van Biesbroeck at Yerkes and by Dr. H. M. Jeffers at Lick.

Now the job of astronomers will be to take continued observations until the orbit of the comet can be ascertained. It will then be known whether the Peltier comet is approaching or leaving the vicinity of the sun. If it is approaching, the comet may gain brightness, making it visible to the naked eye. It is now of the eighth magnitude, just too faint for unaided observation but easily seen in the northwest sky in early evening with cheap opera or field glasses of low power.

Repaint Your Own Car

[*Continued from page 94*]

Apply the finish fairly thick, using even, rather rapid strokes, but don't put it on so heavily that it runs down faster than you can smooth it out. When a whole panel is covered, wipe as much paint as possible out of the brush on the edge of the can, and brush over the freshly-painted surface with firm horizontal strokes, wiping the brush off occasionally. When you have gone over the panel in this fashion, repeat the procedure using vertical strokes and somewhat lighter pressure. Finally, go over the surface very lightly with uniform horizontal strokes again. In the meantime, see that the paint doesn't run down and collect in ridges or lumps. This technique is used by professionals to obtain a perfectly uniform and beautiful finish that dries without leaving a trace of a brush mark.

Ordinarily, one coat of the new finish will be sufficient if the original paint job is still in fair condition. However, if you apply a second coat, let the first one dry at least 12 hours.

If the old paint job on your car is badly chipped or cracked, with rusty spots here and there, the only way to do a satisfactory piece of work is to remove all the paint down to the bare metal. Paint remover that works equally well on lacquer, enamel or varnish is quite inexpensive. Generally speaking, one quart is enough for about 25 or 40 square feet of surface. After it softens the paint, it can be wiped off with a cloth, or scraped off.

When all the paint has been removed, wash the metal thoroughly, go over it with steel wool and very fine sandpaper, and polish all rusty spots with sandpaper until they are bright. Wipe off the surface with gasoline first, then with a sponge soaked in water, and finally dry it with a chamois.

From this point, follow the same procedure as given for painting over the original finish. After the priming coat, three more coats will be sufficient. Let each coat dry thoroughly and go over it with wet sandpaper No. 0000 before applying the next. When the final coat dries, you may apply whatever type of polish or wax you choose, and you'll have a paint job you'll be proud of—one that ranks with a professional job.

The advice given herewith is of equal interest to builders of midget cars and trailers who want to put a fine finishing touch to their products. —*Manley Mills.*

Life-Saver Made Of Metal

A metal life-saver, consisting of four hollow, water-tight sections, has been developed in Berlin, Germany, as a substitute for ordinary life preservers.

Advantages claimed are that the metal one is lighter, more durable and is fireproof.

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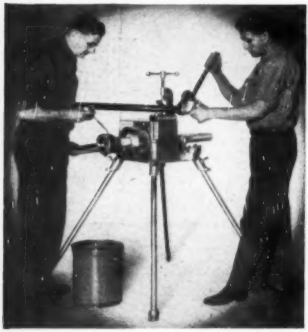

Specially designed so two men can work at the same time, one threading and the other bending or making fittings, this powered pipe-fitting machine handles pipe up to 8 inches in diameter. An electric motor of one-half horsepower is featured.

Requiring no moistening, a new line of labels features an adhesive that will stick to non-porous surfaces such as glass, metals, etc., yet can be removed without leaving a trace of their presence.

Developed for automobile use, a new flashlight has a rechargeable miniature storage battery. When not in use it rests in a frame connected to the automobile's regular storage battery, which keeps it properly charged.

Made of a special brand of glass, a new percolator pump can be easily cleaned and never discolors or absorbs rancid odors, it is claimed.

A safety device for cars equipped with hydraulic brakes, which seals off either front or rear lines if a leak occurs so that the other line will continue to operate.

An automobile lock that prevents the rear doors from opening while the engine is running. It operates from the manifold vacuum and does not interfere with the regular door locks. A "peace of mind" invention that appeals to mothers who drive their children to and from school.

Made of stainless, rust-proof steel this streamlined automobile radio antenna develops strong signals and is unaffected by rain, snow or sleet. It fits all sedans, coaches and coupes.

A flexible all-steel hose designed for such severe service as diesel exhaust connections. Highly resistant to vibration.

A new type of plaque which is made of a rubber composition and given a metallic finish to resemble bronze, silver or gold.

A three-wheeled, rubber-tired delivery truck, powered by a motor of only two horsepower and equipped with a two-speed transmission. Hauls a 400-pound load.

A new metal cleaner that removes stains and oxides from copper, brass, bronze and other metals except aluminum, iron and zinc cleans by chemical action and requires no rubbing. It is applied with a brush or rag.